Reconnaissance soil survey of the Brazeau Dam area

Report No. 40

Alberta Soil Survey

Agriculture Canada

Research Branch

Direction générale de la recherche

Reconnaissance soil survey of the Brazeau Dam area

Mapped by T. W. Peters, Agriculture Canada
Prepared by Pedology Consultants and Agriculture Canada

Alberta Soil Survey Report No. 40
Alberta Institute of Pedology Report S-81-40

Land Resource Research Institute
Research Branch, Agriculture Canada
Ottawa, Ontario
1981

The cover illustration is a westerly view across Brazeau Lake, with the powerhouse in the foreground.
Photograph courtesy of the Government of Alberta.

Copies of this publication are available from
Agriculture Canada – Soil Survey
Terrace Plaza, Calgary Trail South
Edmonton, Alberta
T6H 5C3
or from
Faculty of Extension
University of Alberta
Edmonton, Alberta
T6G 2E1

Cat. No. A57–351/40E ISBN: 0-662-11328-4
1.5M–3:81

CONTENTS

FIGURES

PLATES

TABLES

PREFACE

The soil survey of the Brazeau Dam area is part of the program to inventory Alberta's soil resources on a general scale. The purpose of this program is to provide baseline data on the distribution and properties of soils in the province. Such information is basic to land use planning.

This report contains descriptions of the soils of the Brazeau Dam area, stressing the fact that soils, as part of the landscape, are one component of the environment. A brief treatment of the geology, history, climate, and vegetation of the area is presented as background information to a general understanding of the landscape. The complete report consists of the written text and the soil map. Soil units are identified on the map, described briefly in the legend, and treated at greater length in the text. The map units are discussed in terms of the landscapes and environments where they occur within the framework of an ecological land classification.

Discussion on use and management of the soils is included. The soil units are rated for various uses including forestry, wildlife, agriculture, recreation, and selected engineering uses.

ACKNOWLEDGMENTS

The soil survey of the Brazeau Dam area was conducted by the Soil Survey Unit of Agriculture Canada, in cooperation with the Research Council of Alberta and the Soil Science Department of the University of Alberta.

The project spanned a 25-year period and many people were involved. The principal field work was done by T. W. Peters, but other contributors included A. A. Kjearsgaard, H. Hortie, R. E. Wells, T. Sommerfeldt, A. Brunelle, and P. H. Crown. Field assistants included E. Jensen, O. Ree, R. Arguelles, J. Carson, B. Walker, and S. Kocaoglu. Laboratory support included work by A. McKeague, W. McKean, A. Schwarzer, and others.

Special appreciation is extended to J. Tajek for final map editing and compilation, and the drafting of all the figures in the report. Final cartographic services were provided by the Land Resource Research Institute, Agriculture Canada, Ottawa.

The report and map legend were compiled and prepared by L. J. Knapik of Pedology Consultants, Edmonton, and W. W. Pettapiece of Agriculture Canada.

J. A. Shields, Land Resource Research Institute, reviewed the manuscript. Agriculture Canada published the report and map.

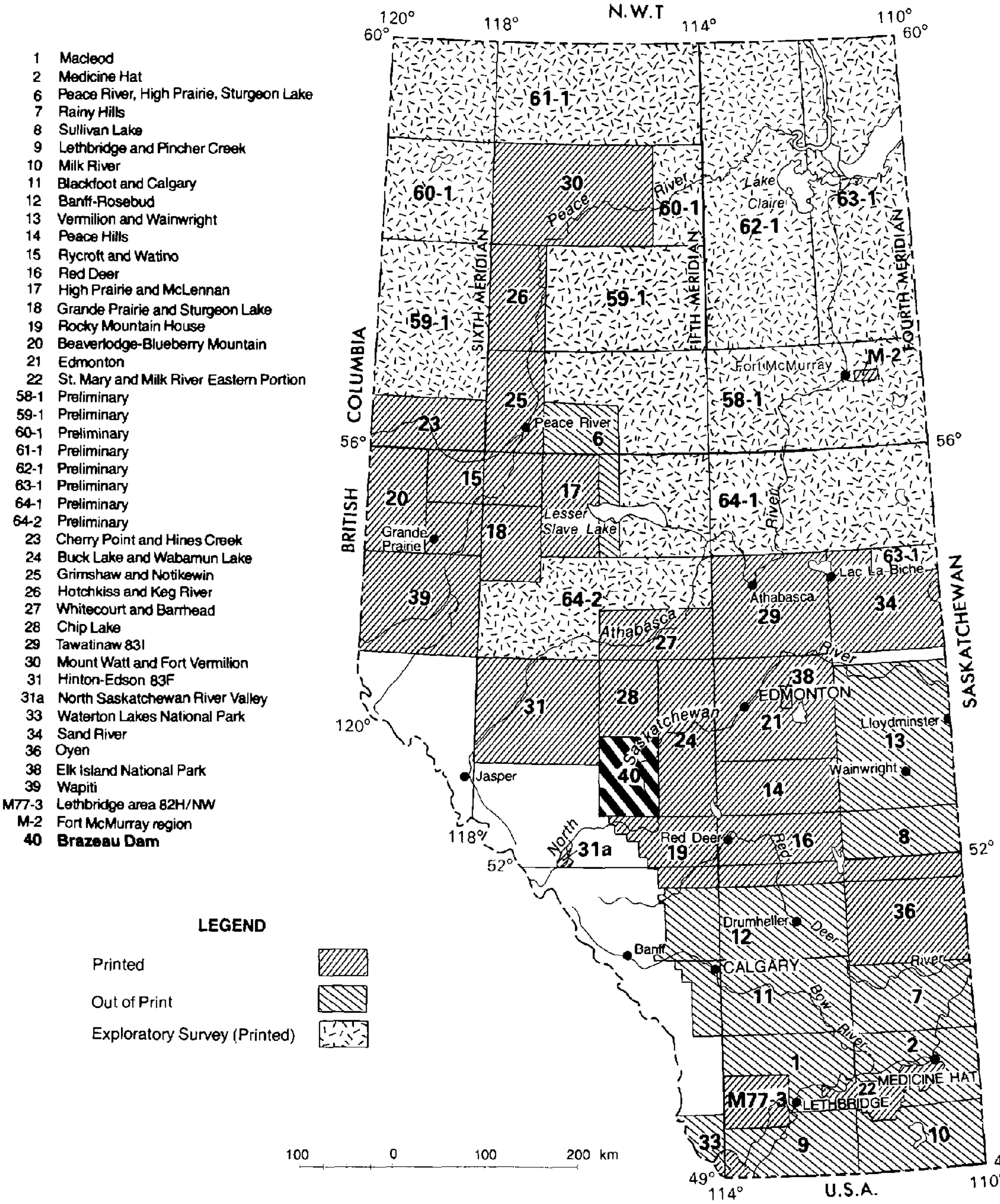


Fig. 1. Soil surveys in Alberta.

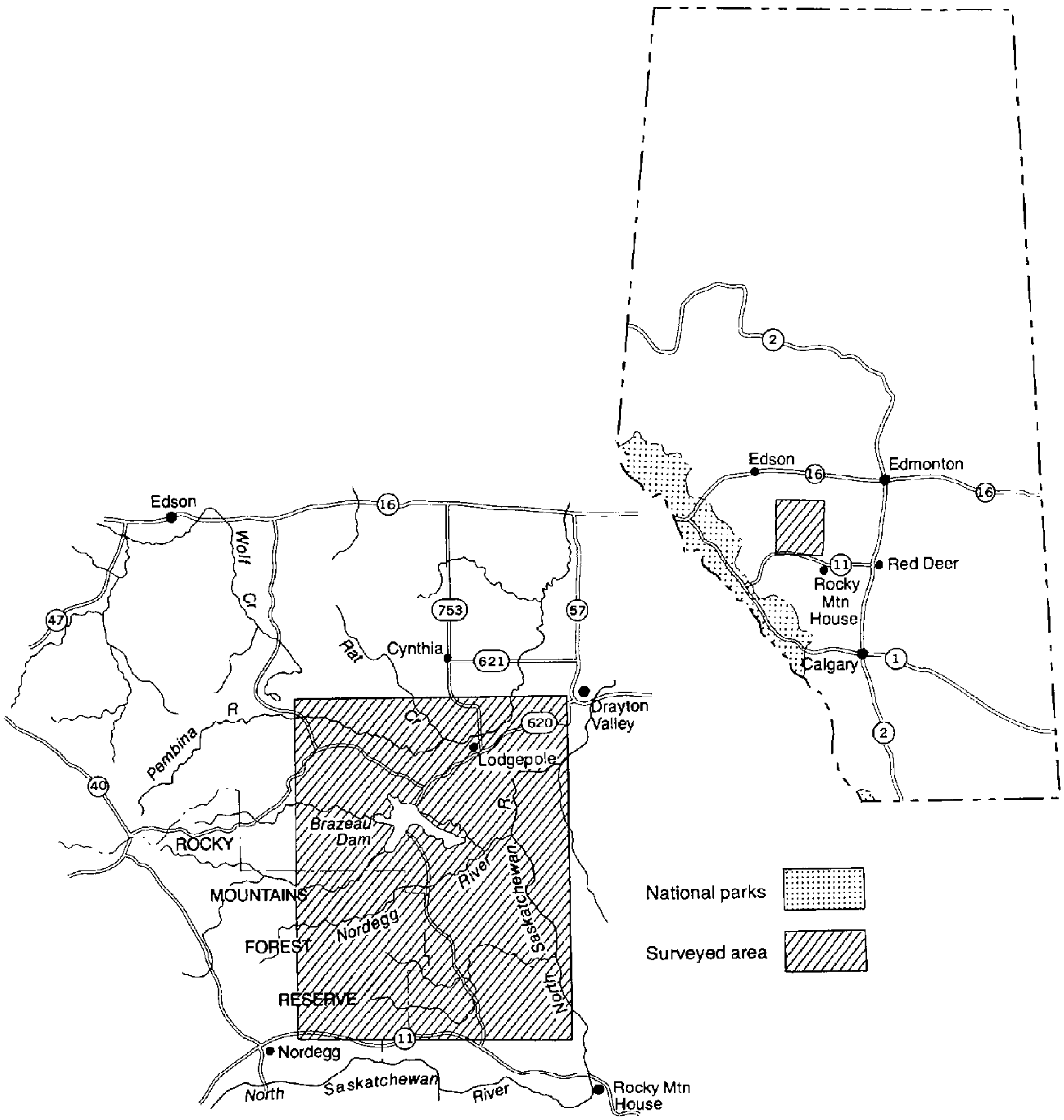


Fig. 2. Location map.

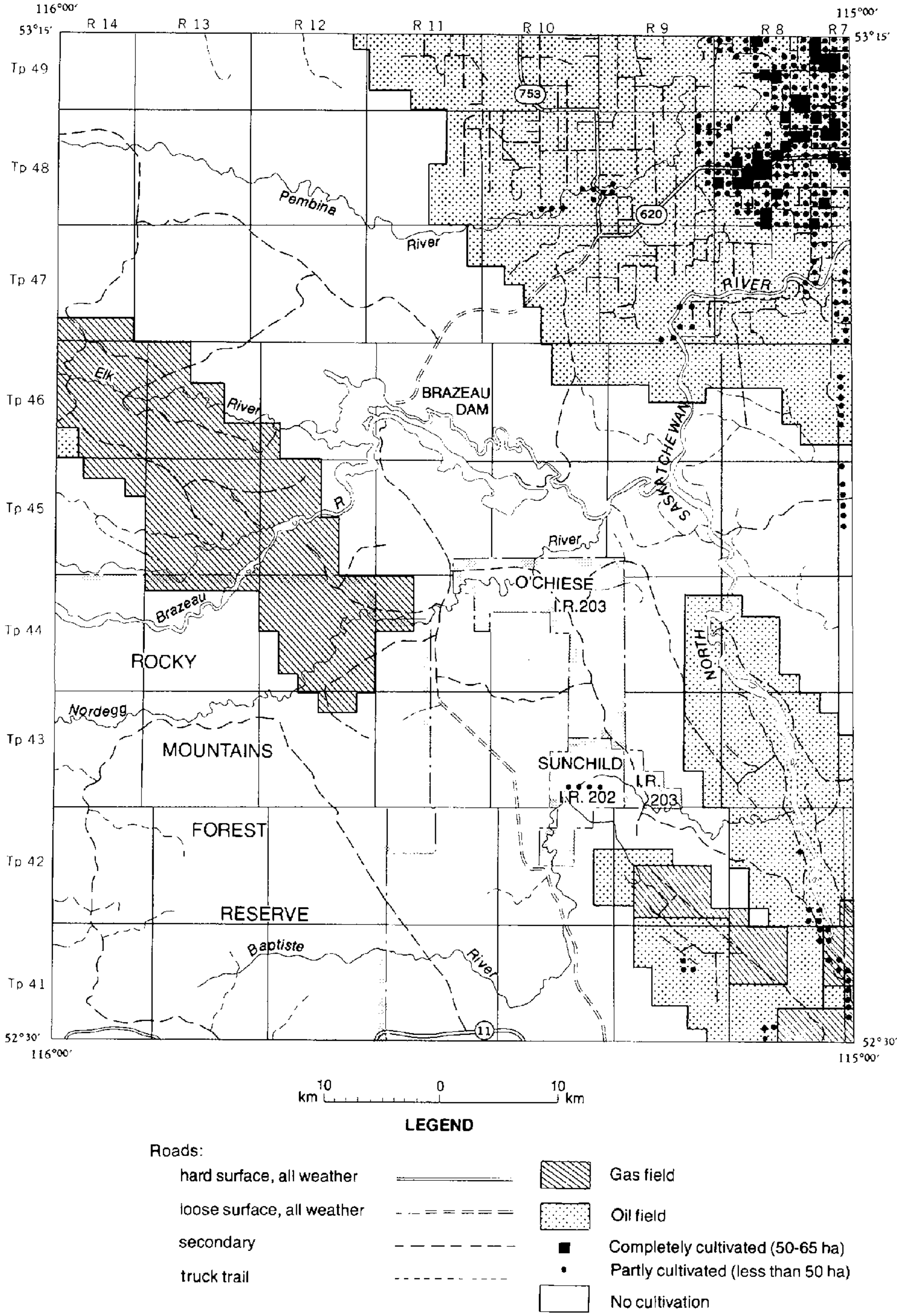


Fig. 3. Land use map.

1. THE AREA

1.1 LOCATION AND EXTENT

The Brazeau Dam area, located in west-central Alberta (Figs. 1 and 2) covers approximately 5650 km^2, extending 83 km from north to south and 67 km from east to west. The area is located between 115° and 116°W longitude and between 52°30′ and 53°15′N latitude in what is known as the Eastern Slopes region of Alberta (Fig. 3). It includes townships 41 to 48 inclusive plus part of township 49 in ranges 8 to 14, west of the 5th meridian. It appears on National Topographic Survey sheet 83B-NW and a portion of 83G-SW.

This portion of western Alberta is mostly unsettled, forested land. The only population centers in the area are the hamlets of Lodgepole and Violet Grove, and the O'Chiese and Sunchild Indian reserves. Drayton Valley, Rocky Mountain House, and Nordegg lie just out of the area to the northeast, southeast, and southwest, respectively. The Brazeau Dam and hydroelectric plant are located in approximately the center of the area.

1.2 HISTORY AND LAND USE

Before the arrival of European man, the Brazeau Dam area was probably occupied for several thousand years by Neolithic and modern Indians. The archaeological record for this period of subsistence activity is scarce. At the time the first white men came, the area was occupied by Piegan, Stoney, and possibly Kootenay Indians.

The fur trade provided the impetus for Europeans to come to the area. Anthony Henday, the first white man in Alberta, wintered in 1754–55 near the present location of Rocky Mountain House. Peter Pangman pioneered the North Saskatchewan River route as far as the mouth of the Clearwater River in 1789. The first white residents came in 1799 when the North West Company built Rocky Mountain House and the Hudson's Bay Company built Acton House, both near present-day Rocky Mountain House. Two other small posts were built in the Lodgepole area, Boggy Hall on NE3-47-9-W5 (1808–10), and Pembina House (circa 1803). David Thompson set out from Rocky Mountain House on his journey to the Pacific in 1811. Dr. Hector, a member of Palliser's party, visited the area in 1858 (Spry 1968). The Brazeau River is named after a Hudson's Bay Company factor who was at Rocky Mountain House in 1858–59. Rocky Mountain House was abandoned in 1875. References to the history of the area may be found in Gish (1952) and MacGregor (1949, 1972).

The pattern of trapping and hunting gradually changed, with the first farmer-settlers appearing in the early 1900's. Logging operations began about 1910. Initially they were small operations producing railroad ties, but logging increased in the 1920's and 30's and was an important industry in the area until the 1960's. White spruce and lodgepole pine were the main species utilized.

Coal mining flourished for the first half of the twentieth century in the Alexo–Saunders–Nordegg district, influencing the southwestern corner of the area.

Agriculture slowly penetrated along the eastern side of the area when several settlers arrived from the dry prairies during the 1930's. Small sawmills and gold panning in the North Saskatchewan River supplemented their income. The Sunchild and the O'Chiese Indian reserves were established in 1945 and 1947.

Geophysical exploration for oil and gas began in the 1940's and drilling started in the early 1950's. There are now hundreds of kilometres of roads, cutlines, and pipelines in the area, providing access for hunters, fishermen, and land seekers. Energy resources are very important in the area, which contains four oil and gas fields, gas processing plants, and the Alberta Gas Trunk Line. The Brazeau Reservoir and hydroelectric installation at the Big Bend site is the largest in Alberta. The dam is 121 m high, and the plant produces 355 000 kW.

Recreational use of land has become increasingly important in recent years. Most of the recreational activity in the Brazeau Dam area is centered on hunting and fishing. Information on the resources and allocation of land in the area was compiled in the *Foothills Resource Allocation Study* (Multiple Land Use Planning Section, Alberta Forest Service) according to drainage basins in 1973. This information was part of the basis for development of *A Policy for Resource Management of the Eastern Slopes*, produced by Alberta Energy and Natural Resources in 1977. This policy statement governs land use zoning in the area.

Agricultural land use is confined to small areas in the northeastern and southeastern portions of the mapped area (Fig. 3).

2. THE ENVIRONMENT

2.1 PHYSIOGRAPHY

The map area is located mainly on the hills and plateau of the Western Alberta Plain (Bostock 1970), with the southwest corner of the area extending into the Rocky Mountain Foothills (Fig. 4). These broad physiographic *regions* have been subdivided into *land districts* with distinctive patterns of relief, surface form, and elevation, and broad vegetation and soils patterns. The land districts are delineated in Fig. 4, and described later in this report.

There is a general rise in elevation from northeast to southwest. The low hills and plains in the northeastern and central parts of the area range from 950 to 1050 m, with occasional ridges rising to 1150 m. Local relief is generally less than 10 m. In the rolling and hilly upland areas (excluding the Foothills) elevations range from 1000 to 1200 m with local relief of approximately 30 m. In the Foothills area, elevations range from 1150 to 1500 m. The hilly and ridged topography has local relief of 50–100 m, and steep slopes are common. Throughout the map area, the ridges trend northwest–southeast, following the trend of the bedrock structure.

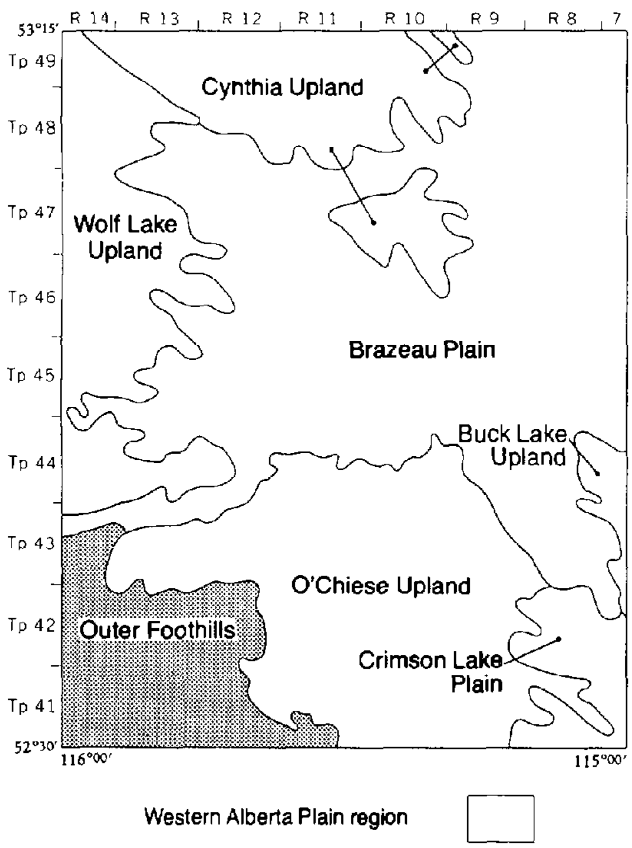


Fig. 4. Physiographic regions and land districts.

The area is drained by the Athabasca and North Saskatchewan river systems (Fig. 5). The Pembina River and its major tributaries, Dismal Creek, Rat Creek, and Paddy Creek, which drain the area north of Brazeau Dam, are part of the Athabasca River system. The North Saskatchewan River and its main tributaries, the Brazeau, Nordegg, Elk, and Baptiste rivers, drain the remainder of the area. Drainage systems are poorly integrated over much of the area; consequently, there are large areas of bog. The two drainages are parts of a continental divide, with the Athabasca waters flowing north to the Arctic Ocean through the Peace, Slave, and MacKenzie rivers, and the North Saskatchewan draining east into the Atlantic Ocean through Lake Winnipeg, Nelson River, and Hudson Bay.

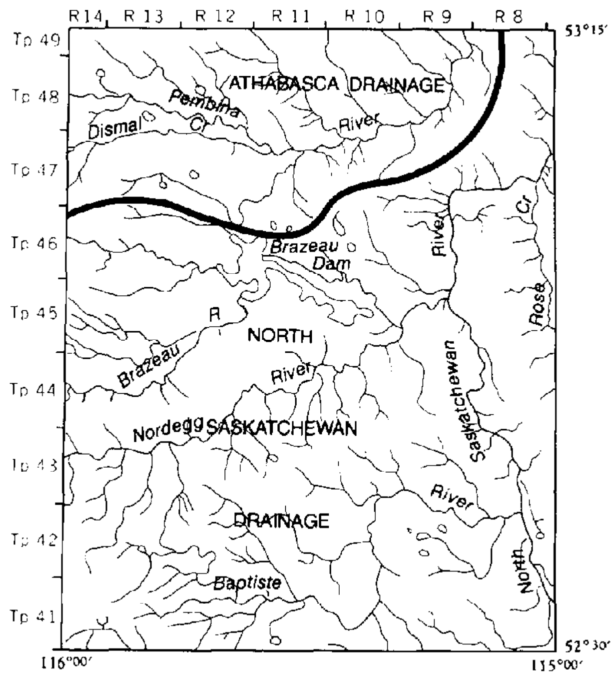


Fig. 5. Drainage systems of the Brazeau Dam area.

2.2 BEDROCK GEOLOGY

The Western Alberta Plain portion of the Brazeau Dam area is underlain by strata of Paleocene (Upper Cretaceous–Tertiary) age belonging to the Paskapoo formation (Green 1972), as shown in Fig. 6. The formation is made up of calcareous sandstones, siltstones, and mudstones, which have hard and soft layers. The bedrock lies nearly flat, with the harder sandstone layers forming ridges in the landscape.

In the Foothills, formations are folded and thrust-faulted due to the influence of mountain-building processes. The formations, mainly of Cretaceous age, dip to the southwest and trend northwest–southeast. The Brazeau formation, consisting of a nonmarine shale-

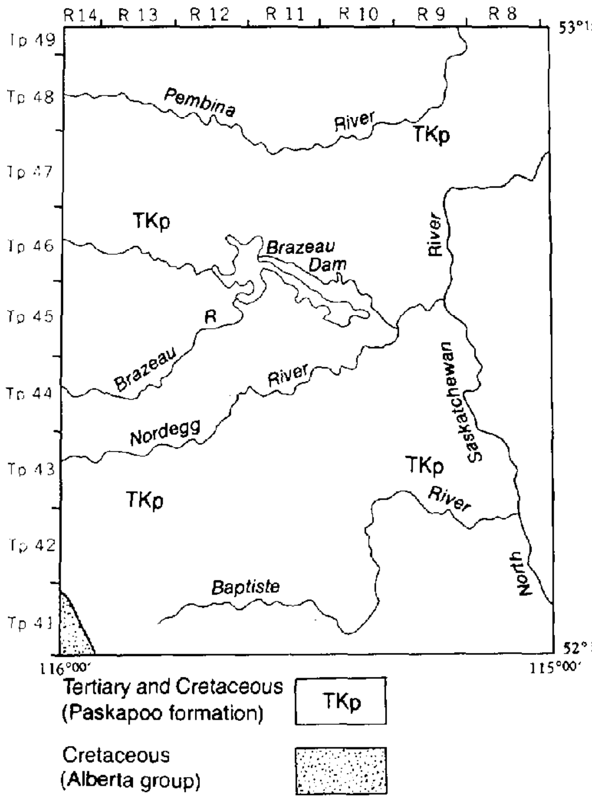


Fig. 6. Bedrock geology of the Brazeau Dam area.

sandstone sequence (correlative to the Paskapoo formation), is the most common surface bedrock. The Brazeau formation is underlain by thick marine shales of the Blackstone and Wapiabi formations (Upper Cretaceous) which are separated by the thinner sandstone-shale sequence of the Bighorn formation.

2.3 SURFICIAL GEOLOGY

The entire area is covered with glacially derived materials resulting from deposition during deglaciation and the resorting of these deposits by glacial meltwater or by wind (Fig. 7). The surficial materials have been mapped by the Research Council of Alberta at a scale of 1:250 000. Boydell et al. (1974) mapped three tills in the 83B portion of the Brazeau Dam area. Jackfish Creek till occurs in the Outer Foothills land district in the southwestern corner of the area. This is a loamy textured till of Rocky Mountain (Cordilleran) origin, which contains a large amount of carbonate rocks. The Sylvan Lake till, in the Buck Lake and Cynthia upland areas, was deposited by the continental ice sheet. It is a clayey till that contains some granite pebbles derived from the Precambrian Canadian Shield where the ice sheet originated. Between the Continental and Cordilleran tills is a mixed till, called Athabasca till, which occurs in the Wolf Lake and O'Chiese uplands. From east to west this till grades from clayey to loamy texture, and from containing mostly crystalline rocks such as granites to containing a large percentage of carbonate rocks.

During deglaciation, meltwater from the receding glaciers was impounded by the continental ice sheet which was blocking drainage outlets to the east. This resulted in a series of glacial lakes which trapped and sorted sediments.

The sands, silts, and clays found in the Brazeau Plain and Crimson Lake Plain land districts are mostly of glaciolacustrine origin. The sands and silts are most common at the western edge of the lake basin, grading to silts and clays to the east. The sandy deposits are often duned. Much of the uplands has a thin veneer of silty to fine sandy material, which is probably a wind-blown deposit originating from these lake basins and the deltas that were forming into the lakes.

There are a few ice-contact glaciofluvial deposits in the map area, such as eskers in the West Pembina region and gravelly outwash deposits in some of the river valleys.

Interpretations of the surficial geology and bedrock geology for groundwater yield and quality are reported in a paper by Tokarsky (1971).

2.4 CLIMATE

Climate exerts strong controls over the distribution of vegetation and soils and the possibilities for land use. Climatic data for the area are limited, with only summer data available from the fire towers. However, data from Drayton Valley, Rocky Mountain House, and Nordegg give a general indication of annual climatic conditions.

The climate is cool, subhumid with long, cold winters and relatively warm summers. Mean annual temperature in the area is about 2°C, with January the coldest month and July the warmest (Table 1).

As elevation increases from the plains to the uplands and foothills the lengths of snow-free period, growing season, and frost-free period decrease considerably.

The frost-free period is 95 days at Rocky Mountain House and is approximately the same at Drayton Valley, but is only 42 days at Nordegg (Longley 1967). Frost can occur in every month of the year in the Foothills areas depending on elevation, aspect, cover, and nearness to water bodies or bogs. Many of the bogs have frozen layers that persist until midsummer. Forestry lookouts are located on high divides and have rapid air drainage with the result that they may escape many of the frosts recorded at lower elevations. They may therefore bias the results toward a longer frost-free period than is actually the case for the surrounding countryside.

The effective growing season decreases from approximately 160 days on the east side of the area to 145 days or less in the higher areas to the west (Table 1). The number of degree-days greater than 5°C decreases from approximately 1100–1200 at Rocky Mountain House and Drayton Valley to the 900 degree-day range in the upland in the western part of the area.

A trend of increasing precipitation from east to west is evident (Table 2). The precipitation from May to September (essentially the growing season) is in the order of 300–350 mm on the eastern plains and increases to about 450 mm in the western uplands. The annual precipitation ranges from about 450 mm in the east to probably 600 mm in the west.

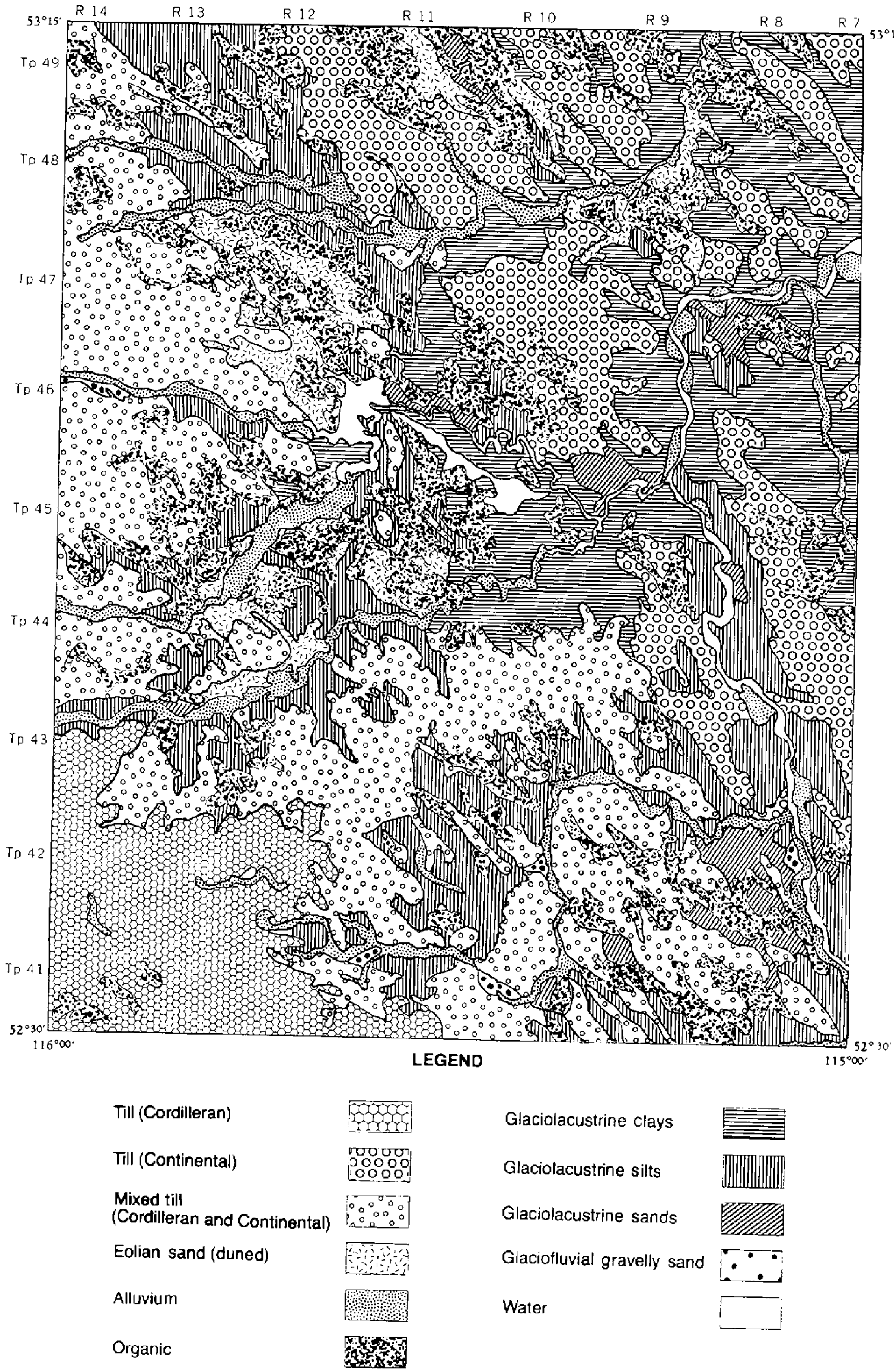


Fig. 7. Surficial materials of the Brazeau Dam area.

Table 1. Mean monthly temperatures (1941-1970)

Station	Elevation (m)	Mean temperature (°C) J	F	M	A	M	J	J	A	S	O	N	D	Ann.	Growing season[1]	Degree-days[2]
Alder Flats LO	1976	—	—	—	—	9	13	16	14	10	—	—	—		160	1150
Brazeau LO	1089	—	—	—	—	9	12	15	14	9	—	—	—		145	930
Drayton Valley (1975)	854	—	—	-6	1	9	13	18	13	12	5	-3	-10		165	1230
Nordegg	1380	—	—	—	1	6	9	13	12	7	3	-4	-11		145	680[3]
O'Chiese LO	1113	—	—	—	—	9	13	16	14	9	—	—	—		160	1100
Rocky Mountain House	1015	-13	-8	-6	3	9	13	16	14	10	5	-3	-9	3	160	1115
Wolf LO	1098	—	—	—	—	8	12	14	13	9	—	—	—		150	950

[1] Effective growing season: Average number of days between the date the mean daily temperature exceeds 5°C in the spring and falls below 5°C in the autumn.

[2] Degree-days greater than 5°C.

[3] Value seems anomalous.

Table 2. Monthly and annual precipitation (1941-1970)

Station	Elevation (m)	Precipitation (mm) May	June	July	Aug.	Sept.	May-Sept.	Annual
Alder Flats LO	1076	66	96	106	82	54	404	—
Brazeau LO	1089	60	107	111	80	54	412	—
Drayton Valley	854	67	55	46	103	24	295	459
Nordegg	1380	63	103	100	77	50	393	564
O'Chiese LO	1113	74	107	117	94	59	451	—
Rocky Mountain House	1015	56	97	95	72	49	369	544
Wolf LO	1098	63	109	128	80	57	436	—

2.5 VEGETATION

Most of the Brazeau Dam area is covered with coniferous and mixed-wood forests. White spruce (*Picea glauca*) communities generally form the climax in this area. However, there is little climax vegetation at present due to the effects of fire and logging. Seral stands of lodgepole pine (*Pinus contorta* var. *latifolia*) are the most abundant in the area (Plate I*a*). Trembling aspen (*Populus tremuloides*) and, to a lesser extent, balsam poplar (*Populus balsamifera*) compete with lodgepole pine as post-fire pioneers at lower elevations. Black spruce (*Picea mariana*) occurs on poorly drained soils and also on better drained sites in association with lodgepole pine (Plate 1*b*). Black spruce-Labrador-tea (*Ledum groenlandicum*)-sphagnum moss communities occupy the numerous and extensive bogs in the area. Sedge (*Carex* spp.) fens are also common in the poorly drained peatlands.

The forests form a transition from true Boreal to Subalpine regions. Rowe (1972) divides this forest ecotone into two sections, the Lower and Upper Foothills sections of the Boreal Forest region (Fig. 8). Both sections are at present dominated by lodgepole pine, but the Lower Foothills section has a greater abundance of mixed-wood stands.

In the Lower Foothills section, lodgepole pine, trembling aspen, and balsam poplar are the most common tree species. White spruce is only sparsely represented as a result of fire and logging. Black spruce is dominant in very poorly drained areas, and occurs with lodgepole pine in many upland areas. White birch (*Betula papyrifera*) occurs sporadically on upland sites

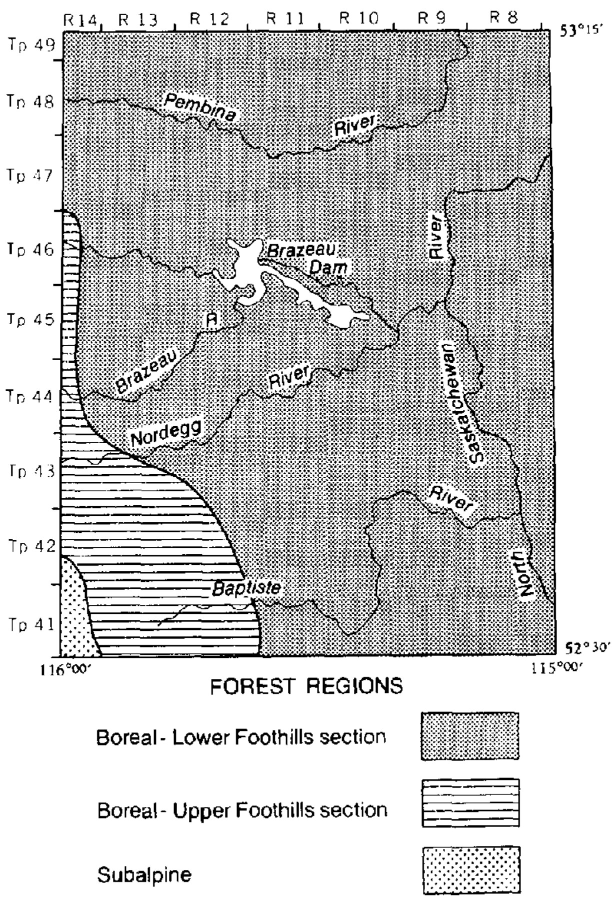


Fig. 8. Forest regions of the Brazeau Dam area (after Rowe 1972).

and tamarack (*Larix laricina*) is found on many of the fens. Both balsam fir (*Abies balsamea*) and subalpine fir (*Abies lasiocarpa*) are common locally.

Most of the area is covered with plant communities that represent stages in succession after fire. Lesko and Lindsay (1973) found secondary succession to be strongly influenced by soil moisture conditions in the Cynthia-Lodgepole area. On well drained sites, lodgepole pine and black spruce were found to regenerate directly after fire and form a stable community. On moderately well to imperfectly drained sites trembling aspen, aspen-birch, or aspen-lodgepole pine regenerate, depending on seed supply. The aspen and pine are gradually replaced by white spruce. On many poorly drained soils, willow (*Salix* spp.) brush regenerates after fire, is replaced by white birch, black spruce, and balsam poplar, and gradually grades to white spruce or black spruce which forms a climax community. Black spruce often regenerates and forms a stable community on poorly and very poorly drained soils without an intermediate stage.

In the Upper Foothills section, lodgepole pine, black spruce, and white spruce are most common. Trembling aspen, balsam poplar, and white birch occur only sporadically. Subalpine fir may occur.

Grasslands occur along the Nordegg, Elk, and Brazeau rivers interspersed with white spruce and lodgepole pine stands.

For more extensive information on the vegetation of the area, refer to:

Moss (1932, 1955)—trembling aspen, general vegetation
Horton (1956)—ecology of lodgepole pine
Horton and Lees (1961)—black spruce in the Foothills
Smithers (1962)—lodgepole pine in Alberta
Duffy (1962)—soils and forest productivity
(1964)—lodgepole pine, site factors and growth
Lesko and Lindsay (1973)—relationships between forests and soils

2.6 GENERAL SOIL CHARACTERISTICS

Soil development and distribution have been reported for the Rocky Mountain House area to the south (Peters and Bowser 1960), the Buck Lake sheet to the east (Lindsay et al. 1968), the Chip Lake area to the north (Twardy and Lindsay 1971), and the Hinton-Edson sheet to the northwest (Dumanski et al. 1972). The soils in the study area are extensions of those described in the above reports and have been correlated with them.

The predominant soils in the Brazeau Dam area are Gray Luvisols. These are forest soils which have a grayish, leached Ae horizon overlying a dark brown Bt horizon with a higher clay content. Luvisolic soils are typical of Boreal environments, forming under forest vegetation in cool, subhumid climates. Orthic Gray Luvisols predominate on the plains of the northeastern portion of the area. Dark Gray Luvisols are of minor occurrence in the Violet Grove area. Brunisolic and Podzolic Gray Luvisols predominate in the upland areas, and in the foothills, correlating with the cooler, more humid climate in the higher elevations of the western and southwestern portions of the area. These soils have a Bm horizon (Brunisolic Gray Luvisols) or a Bf (Podzolic Gray Luvisols) developed in the lower portion of an older Ae horizon.

Eluviated Dystric Brunisols and Brunisolic Gray Luvisols are found on the very sandy materials in the plains areas. These are well drained soils with leached Ae horizons and Bm horizons that show weak morphological development. These soils are usually associated with lodgepole pine or lodgepole pine-black spruce communities.

Gleysolic soils occur in poorly drained positions of the landscape where the water table is near the surface for a significant portion of the year. These soils are cold because of their high water content and experience anaerobic conditions when saturated. A peaty surface layer is often present, overlying the A horizon which may have high humus content (Ahg) or may be leached (Aeg). There is usually a Bg or Btg horizon present overlying a Ckg. These soils are commonly associated with white spruce, black spruce, or sedge-willow communities.

Organic soils (or peat deposits) occur in very poorly drained landscape positions where the water table is at the surface throughout the year. These soils were not differentiated beyond the order level on the soil map, but are usually Mesisols. The organic soils occur in bogs under black spruce-Labrador-tea-sphagnum moss communities, and in fens under sedge communities. They are present in all districts of the map area.

Regosolic soils with minimal horizon formation other than thin, weakly developed Ah horizons occur in the fairly recent fluvial deposits on the floodplains of rivers and creeks.

3. LAND DISTRICTS AND SOIL UNITS

3.1 SOILS IN THE LANDSCAPE

Soils are part of "land"—that assemblage of resources which extends from the atmosphere to some depth below the surface of the earth. The natural attributes of land include climate, landform, soil, vegetation, fauna, and water (Christian and Stewart 1968). When mapping land, or any attribute thereof, we must place emphasis on the ecological whole since there are complex interrelationships between all components of the system.

In this report, soils are presented as part of ecological land systems in order to show more clearly the interrelationships of soils, climate, and vegetation. Ecological land systems are areas of land throughout which there is a recurring pattern of landforms, soils, vegetation chronosequences, and water bodies (after Jurdant et al. 1976). Land systems are subdivisions of land districts, which in turn are subdivisions of land regions. (See Lacate 1969 and Thie and Ironside 1977 for more complete discussions of ecological land classification, or biophysical land classification as it was formerly called.)

3.2 SOIL CLASSIFICATION AND SOIL MAPPING

Soils display variation both vertically and horizontally, and by examining these variations we may recognize soil individuals and patterns of individuals. Vertical variation is in the form of horizons which differ from one another in such properties as color, texture, structure, consistence, and chemical and biological activity. These are parameters used to identify and classify soil individuals within a taxonomic framework such as that described in *The Canadian System of Soil Classification* (Canada Soil Survey Committee 1978).

Soils also vary in the horizontal dimension, as does the rest of the landscape. As geological materials, topography, moisture regime, and vegetation change, so do the soils. Soil mapping consists of delineating collections (or populations) of soil individuals which occupy a characteristic portion of the landscape. Each population of individuals can be defined, recognized, mapped, and treated as a unit for interpretive purposes.

3.3. SOIL SURVEY METHODS

The purpose of a soil survey is to identify and delineate soil patterns in the landscape and to present the information to the user.

Soil mapping is based on the philosophy of pedology—that soils are natural bodies that reflect the influence of their environment. Point observations of soils can be extrapolated to areas by using principles of geomorphology (shape of the earth's surface) and geology, especially surficial geology, combined with vegetation pattern indicators. Aerial photographs are used to delineate areas of similar patterns in the landscape.

The areas delineated generally contain recurring groups of soils. These groups of soils, called *soil units*, are named after the dominant soil or soils in the unit. The units may be fairly homogeneous or very heterogeneous, depending on the complexity of the landscape, and on the scale of mapping. Soil names do not usually cross major physiographic-ecological boundaries.

In this study, mapping was done at a *reconnaissance* scale (1:126 720). At this level of intensity, only general patterns of soils were delineated and represented on the map. The descriptions of the soil units recognized in the study follow in the next section of the report and form the basis for the ensuing interpretations.

The polygons, or individual areas, outlined on the soil map are identified by a soil unit symbol and a topography class symbol; for example,

$$\frac{\text{Hub1}}{5}$$

where Hub1 is the soil unit symbol and 5 the topography class symbol. Soil unit Hub1 contains a dominant proportion of Orthic Gray Luvisols on clay loam till (Hubalta) with a significant amount of Gleyed Gray Luvisols, and a minor amount of Gleysolic soils. These soils occur on morainal landscapes in the Western Alberta Plain. Topography class 5 is moderately rolling land wth 10–15% slopes.

During mapping operations a preliminary map (1:30 000 scale) was made by aerial photo interpretation. This map was used as a base for field data and was revised and reduced to a scale of 1:63 360. Field inspections were made at intervals of approximately 1 km along available roads and trails, and some seismic lines (Fig. 9). The field inspections provide ground-truth data and are used to improve the quality of the soil map. As a final step in preparation of the map, the field-checked version was reduced to publishing scale (1:126 720).

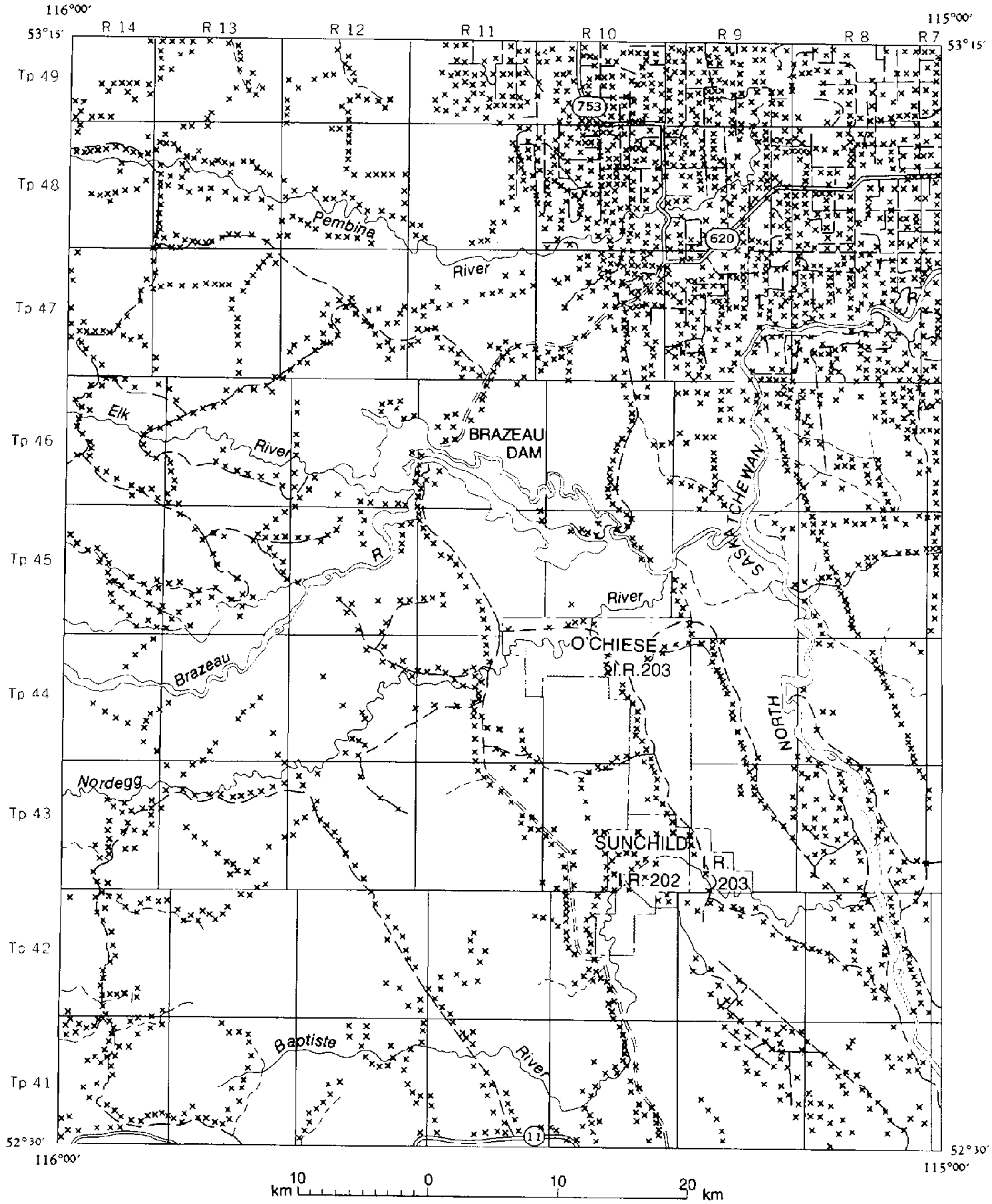
The mapping program in the Brazeau Dam area was initiated in 1948 and completed in 1970. Representative soils were sampled at several sites during the program, and the samples were analyzed in the Alberta Soil Survey laboratory.

3.4 BASIC DEFINITIONS

Although a glossary is provided at the end of this report, the definitions pertaining to soil survey and land classification terminology described in the following sections are conveniently listed below.

Soil classification The systematic arrangement of soils into taxonomic categories on the basis of their characteristics.

Soil survey The systematic examination, description, classification, and mapping of soils in an area. A



LEGEND

Roads:

hard surface, all weather

loose surface, all weather

secondary

Truck trail

Observation points

Fig. 9 Access map.

soil map shows the distribution of soil units in the landscape.

Ecological (biophysical) land classification An inventory of the biological and physical components of the landscape. The land units are based on characteristics of soils, landforms, vegetation chronosequences, and water bodies.

Land region An area of land characterized by a distinctive regional climate as expressed by vegetation.

Land district A subdivision of the land region, defined as an area of land characterized by a distinctive pattern of relief, geology, geomorphology, and associated regional vegetation.

Land system A subdivision of the land district, defined as an area of land throughout which there is a recurring pattern of landforms, soils, vegetation chronosequences, and water bodies.

3.5 RELATIONSHIPS BETWEEN THE ECOLOGICAL LAND CLASSIFICATION AND THE SOIL UNITS

The ecological (biophysical) approach to land classification was used for the organization of all land-related information in the survey area. The initial breakdown recognized two land regions (Fig. 10) based on regional climate-vegetation relationships. They are the Western Alberta Plain: Lower Foothills Boreal; and the Rocky Mountain Foothills: Upper Foothills Boreal. The boundary coincides with Bostock's (1970) physiographic regions and Rowe's (1972) forest regions.

The second stratification recognized seven land districts (Fig. 11), six in the Western Alberta Plain and one in the Foothills. These are essentially subdivisions based on physiography and surficial materials, but they have attendant climate, vegetation, and soils as well (see section 3.6).

The next level of subdivision identifies principal parent materials and then particular soil combinations, including material combinations (Table 3). The soil units correspond to ecological land systems and are described in terms of parent material, landform, vegetation, climate, and soils (see section 3.7). Ecological "land types" may be extracted from the information but are not mapped separately at this level of intensity.

3.6 GENERAL DESCRIPTIONS OF THE LAND DISTRICTS

BRAZEAU PLAIN AND CRIMSON LAKE PLAIN LAND DISTRICTS

Elevation range: 850–1050 m
Local relief: 5–10 m
Landforms: level to undulating glaciolacustrine plains; glaciolacustrine blankets and veneers over rolling moraines; duned eolian plains; bogs and fens; fluvial

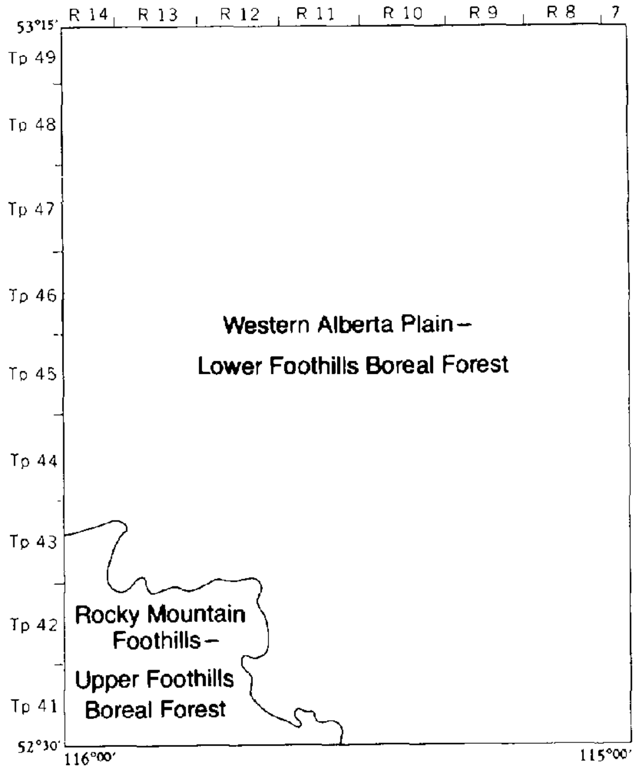


Fig. 10. Land regions of the Brazeau Dam area; land regions are areas of land characterized by distinctive climate as expressed by vegetation.

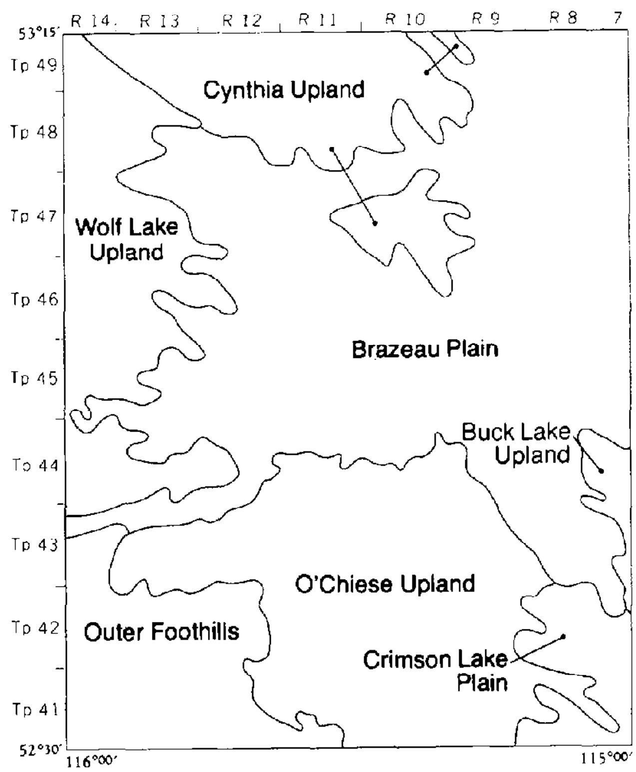


Fig. 11. Land districts of the Brazeau Dam area; land districts are areas of land characterized by distinctive patterns of relief, geology, geomorphology, and associated regional vegetation.

Table 3. Ecological land classification and major soil units

Land district	Material	Main soil units	Main tree species
A. Western Alberta Plain–Lower Foothills Boreal land region			
A.1 Brazeau Plain	Sands (eolian)	Heart (Ht, Ht-Kz)	Lodgepole pine (black spruce)[1]
	Fine sands and silts (mainly glaciofluvial)	Caroline (Ca1, Ca2, Ca3, Ca4) Codner (Cn)	Lodgepole pine, aspen, black spruce Willow (spruce, poplar)
	Clays (lacustrine)	Maywood (Mw1, Mw2, Mw3, Mw-Ca) Macola (Ml) Raven (Rv)	Aspen; white spruce Aspen, white spruce; willow Black spruce, white spruce
	Clay loam (morainal)	Hubalta (Hub1, Hub3, Hub-Mw)	Aspen, lodgepole pine, spruce
	Organic	Organic (O)	Black spruce or sedge
A.2 Crimson Lake Plain	Sands (eolian)	Heart (Ht, Ht-Kz)	Lodgepole pine (black spruce)
	Fine sands and silts (glaciofluvial or eolian)	Prentice (Pc1, Pc2) Caroline (Ca1, Ca2, Ca3, Ca-Lob)	Lodgepole pine, aspen Lodgepole pine, aspen, black spruce
	Organic	Organic (O)	Black spruce or sedge
A.3 Buck Lake Upland	Clay loam (morainal)	Hubalta (Hub1, Hub2)	Lodgepole pine, aspen
	Organic	Organic (O)	Black spruce or sedge
A.4 Cynthia Upland	Clay loam (morainal)	Hubalta (Hub1, Hub2)	Lodgepole pine, aspen
	Fine sands and silts (mainly glaciofluvial)	Caroline (Ca2, Ca3)	Lodgepole pine, aspen, black spruce
	Sands (eolian)	Heart (Ht1, Ht-Kz)	Lodgepole pine (black spruce)
	Organic	Organic (O)	Black spruce or sedge
A.5 O'Chiese Upland	Loamy till (morainal) over bedrock; some silty veneers	Lobley (Lob-Sch1, Lob-Sch2, Lob-Sch-O, Lob-Sch-Msk)	Lodgepole pine
	Silty veneers (eolian or glaciofluvial)	Sunchild (Sch1, Sch2, Sch-Lob, Sch-Lob-O)	Lodgepole pine, aspen
	Organic	Organic (O)	Black spruce or sedge
A.6 Wolf Lake Upland	Loamy till (morainal) with bedrock outcrops and silty veneers	Wildhay (Wld-Sch, Wld-Sch-Msk, Wld-Msk1, Wld-Msk2)	Lodgepole pine (aspen)
	Organic	Organic (O)	Black spruce or sedge
B. Rocky Mountain Foothills-Upper Foothills Boreal land region			
B.1 Outer Foothills	Loamy till (morainal) with bedrock outcrops and some silty veneers	Stolberg (Stb-Ndg, Stb-Kz, Stb-Ndg-Msk)	Lodgepole pine (subalpine fir, spruce)
	Organic	Organic (O)	Black spruce or sedge

[1] Minor occurrence.

plains; rolling morainal plains (plus some morainal outliers of the Buck Lake Upland).
Materials: glaciolacustrine clays, silts, and sands; glaciofluvial silts, sands, and gravels; eolian sands; clay loam till; moss and sedge peat (Fig. 12 and Plate Ic).

General soil patterns

The soils of the Brazeau Plain are developed mainly on glaciolacustrine sands, silts, and clays. The topography is usually gently sloping, but may be rolling where underlying morainal deposits and bedrock control the surface form. Orthic Gray Luvisols on glaciolacustrine clays (Maywood—Mw soils) are predominant in the northeast portion of the plain. Brunisolic Gray Luvisols on silts and fine sands (Caroline—Ca soils) and on sands (Prentice—Pc soils), intermixed with Brunisolic soils on duned sand (Heart—Ht soils), are common on the remainder of the plain. Orthic Gray Luvisols (Hubalta—Hub soils) with minor Podzolic Gray Luvisols (O'Chiese—Oh soils) occur on till ridges and local upland areas dispersed throughout the plain. Organic soils developed on bogs and fens are of widespread occurrence in the land district.

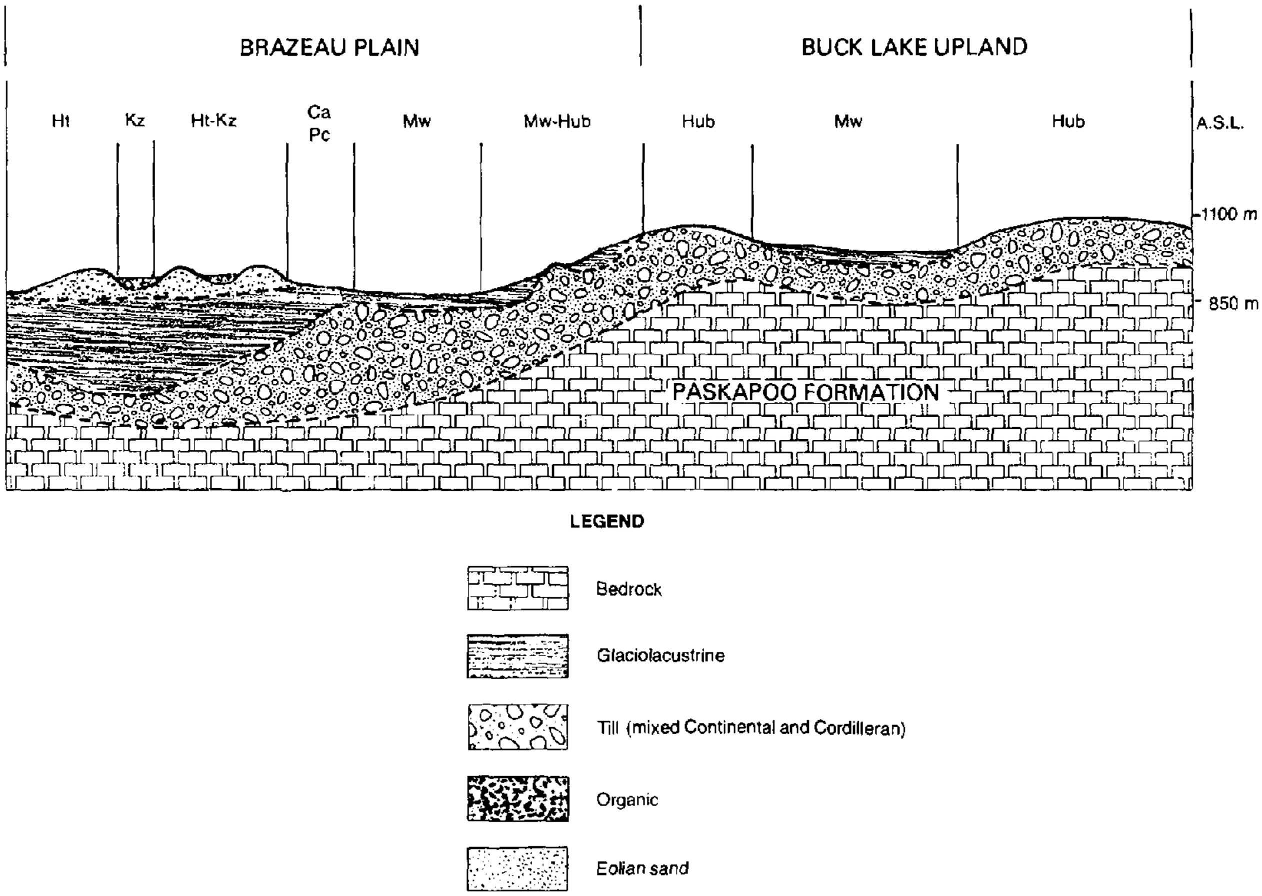


Fig. 12. Soil unit patterns in the Brazeau Plain and Buck Lake Upland.

BUCK LAKE UPLAND LAND DISTRICT

Elevation range: 970–1050 m
Local relief: 10–20 m
Landforms: rolling moraines; morainal blankets overlying bedrock.
Materials: clay loam till overlying Paskapoo formation (Fig. 12).

General soil patterns

Orthic Gray Luvisols on clay loam till (Hubalta—Hub soils) are the predominant soils in freely drained positions of the landscape. Gleyed Gray Luvisols (Bremay—Bm soils) and Gleysolic soils are of minor extent, occurring in areas of groundwater seepage and in depressions. Mesisols and Fibrisols occur in small bowl bogs in depressional areas.

CYNTHIA UPLAND LAND DISTRICT

Elevation range: 920–1070 m
Local relief: 0–15 m
Landforms: morainal blankets overlying rolling (dissected) bedrock; undulating and hummocky moraines; undulating fluvial and eolian landforms (some as veneers and blankets); bogs and fens.
Materials: clay loam till; glaciofluvial silts and sands; eolian sands; moss and sedge peat.

General soil patterns

This unit is similar to the Buck Lake Upland in that the most prominent features are controlled by Paskapoo sandstone covered by glacial drift. These rolling areas are dominated by Orthic Gray Luvisols (Hubalta—Hub soils). However, this area has been influenced by glaciofluvial activity resulting in substantial dissection and the inclusion of fluvial silts and sands. Brunisolic Gray Luvisols on silts (Caroline—Ca soils) are dominant in the northwest with significant areas of Brunisolic soils on eolian sands (Heart—Ht soils) in the north-central portion of the unit. There is a high percentage of Organic soils associated with the level fluvial areas, particularly along Rat and Paddy creeks and in the northwest.

O'CHIESE UPLAND LAND DISTRICT

Elevation range: 970–1150 m
Local relief: 10–30 m
Landforms: morainal blankets over bedrock; rolling

moraines; glaciolacustrine and glaciofluvial veneers over rolling moraine; bogs and fens.
Materials: loamy till blankets over sandstone; discontinuous silty veneers overlying till; moss and sedge peat.

General soil patterns

The soils of the O'Chiese Upland (Fig. 13) are predominantly Brunisolic Gray Luvisols developed on loamy till (Lobley—Lob soils) and silty blankets (Sunchild—Sch soils). Organic soils and soils developed on sandstone bedrock (Maskuta—Msk soils) are of common occurrence.

WOLF LAKE UPLAND LAND DISTRICT

Elevation range: 1000–1200 m
Local relief: 10–30 m
Landforms: morainal blankets and veneers over ridged sandstone; rolling moraines; eolian and glaciofluvial veneers over moraines; bogs and fens.
Materials: discontinuous silty and fine sandy veneers overlying loamy till blankets and veneers over sandstone (Fig. 14); local deposits of glaciolacustrine or glaciofluvial silts; moss and sedge peat.

General soil patterns

Wildhay soil units cover almost all of the Wolf Lake Upland. The dominant soils of the units are Podzolic Gray Luvisols on loamy till (Wildhay—Wld soils). Brunisolic Gray Luvisols developed on silty to loamy veneers overlying the till (Sunchild—Sch soils) are often associated with the Wildhay soils. The till overlies bedrock at varying depths, and the bedrock is frequently exposed. Eluviated Eutric Brunisols, and occasionally Luvisolic soils, developed on sandstones and mudstones (Maskuta—Msk soils) are generally subdominant soils in the landscape.

OUTER FOOTHILLS LAND DISTRICT

Elevation range: 1100–1500 m
Local relief: 50–100 m
Landforms: morainal veneers and blankets overlying ridged bedrock (Fig. 15 and Plate I*d*); discontinuous silty veneers over morainal blankets; bogs and fens; fluvial blankets and plains.
Materials: discontinuous silty veneers overlying loamy till veneers and blankets over folded and faulted sandstone and shales; moss and sedge peat; fluvial silts and sands in the valleys.

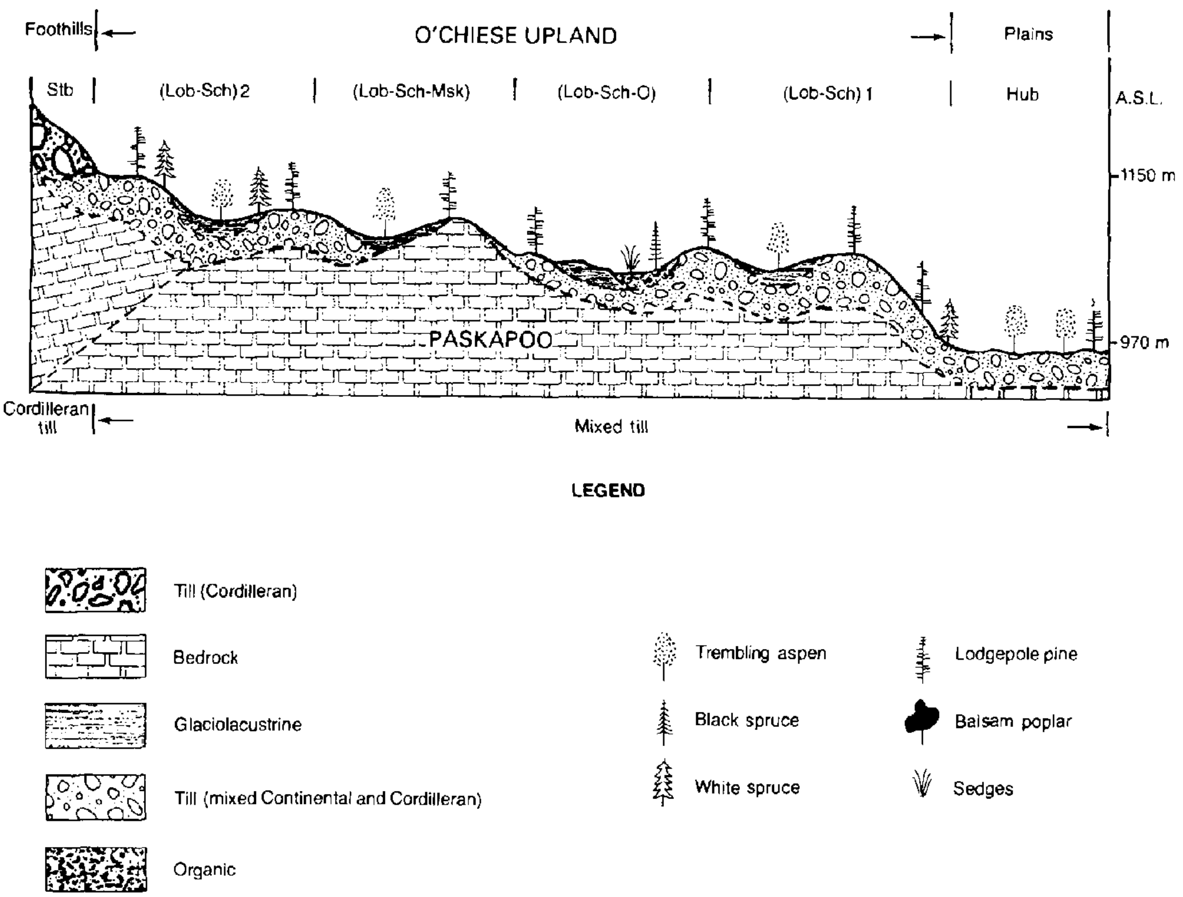


Fig. 13. Soil unit patterns in the O'Chiese Upland.

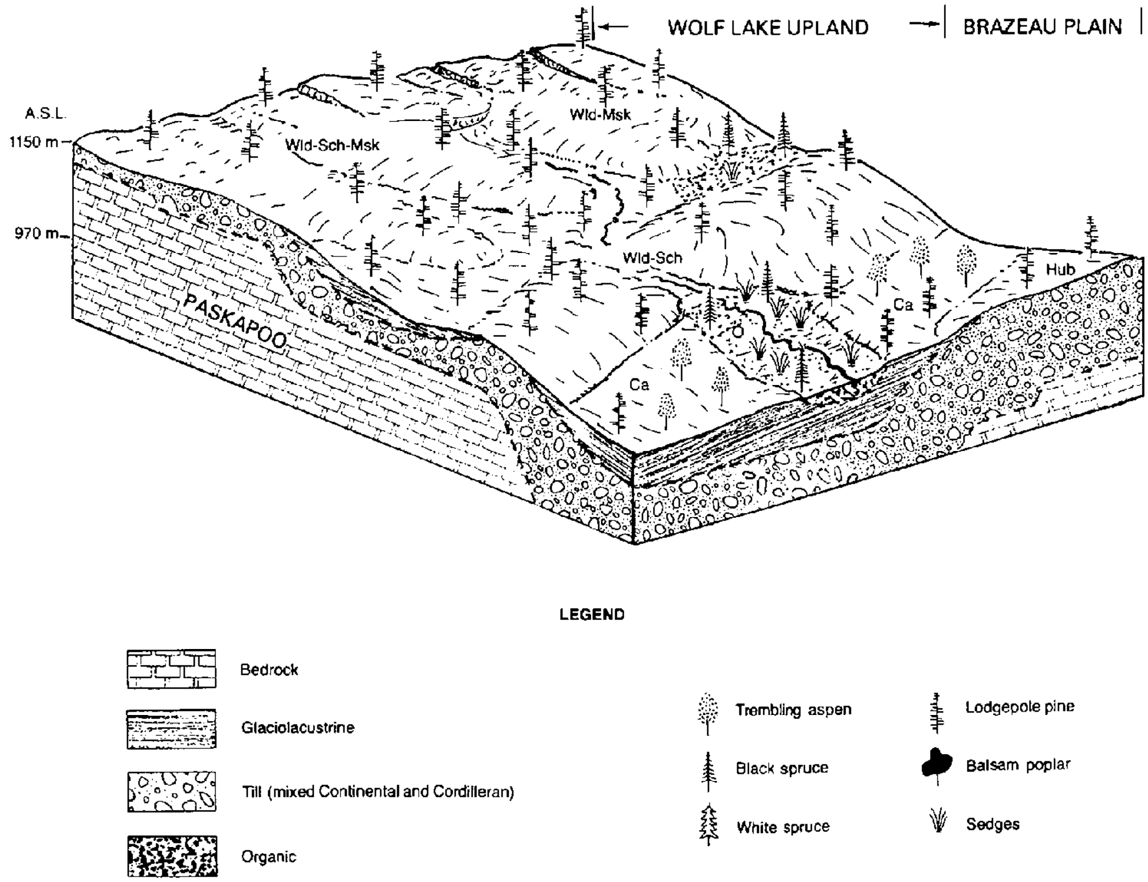


Fig. 14. Soil unit patterns in the Wolf Lake Upland.

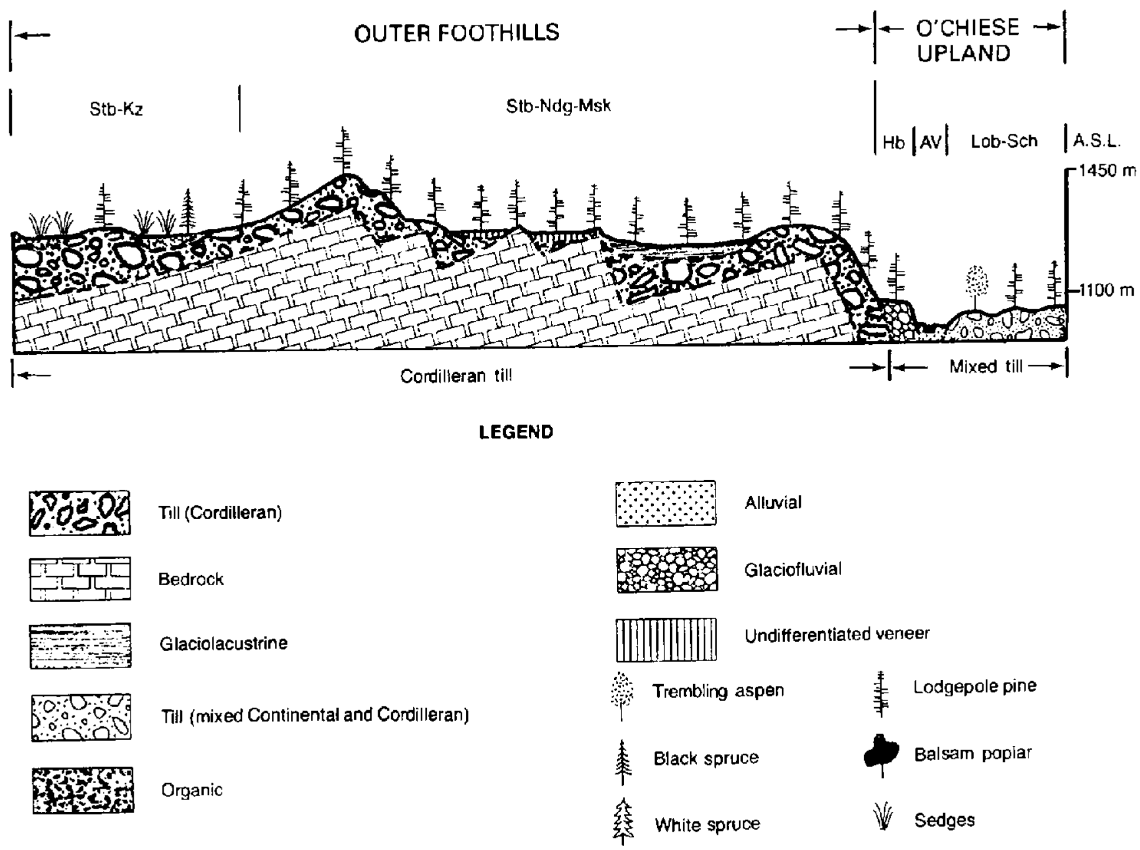
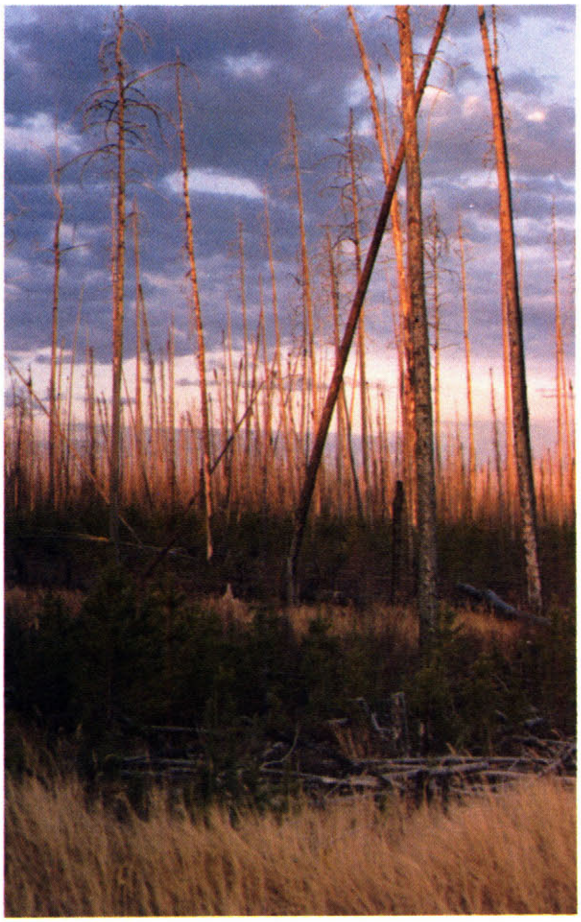


Fig. 15. Soil unit patterns in the Outer Foothills.


a


b


c


d

Plate I

a. Typical vegetation of lodgepole pine regenerated after fire in areas of well drained soils.

b. Lodgepole pine-black spruce community which covers much of the area, stable on well to imperfectly drained soils.

c. Crimson Lake Plain land district, looking west to the O'Chiese Upland, the Foothills, and the Rocky Mountains; the level land with silty and sandy soils is used for hay production.

d. Outer Foothills land district, where thin morainal veneers cover ridged and rolling bedrock, and Gleysolic and Organic soils occupy the swales.

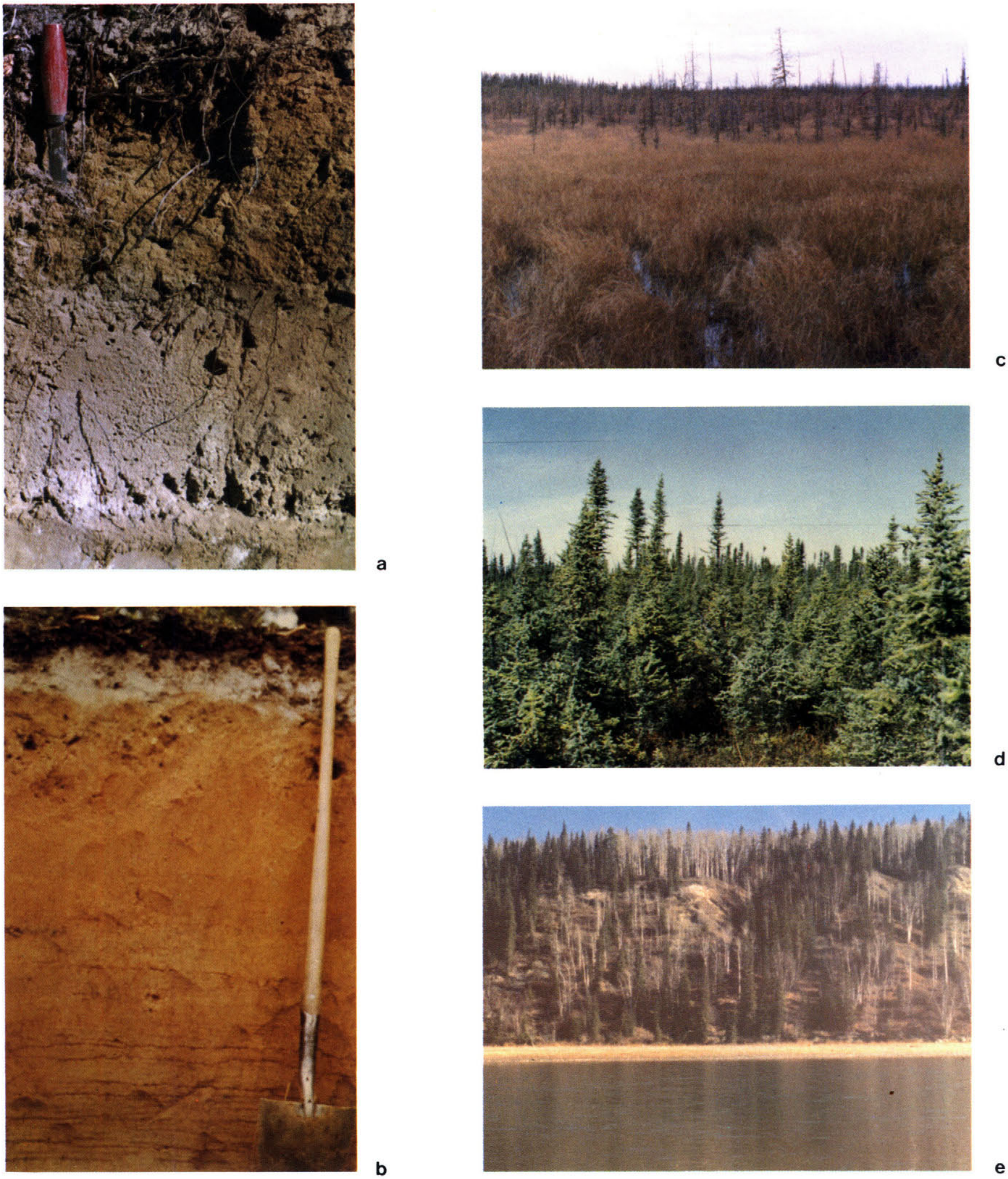


Plate II

a. Caroline profile: Brunisolic Gray Luvisol developed on silts and fine sands.

b. Heart profile: Eluviated Dystric Brunisol on duned sand.

c. Organic land unit (fen): Eaglesham soil developed on mesic fen peat; fens have high water tables and the vegetation is sedge with occasional tamarack trees.

d. Organic land unit (bog), with characteristic black spruce-sphagnum association.

e. RB land unit along the North Saskatchewan River.

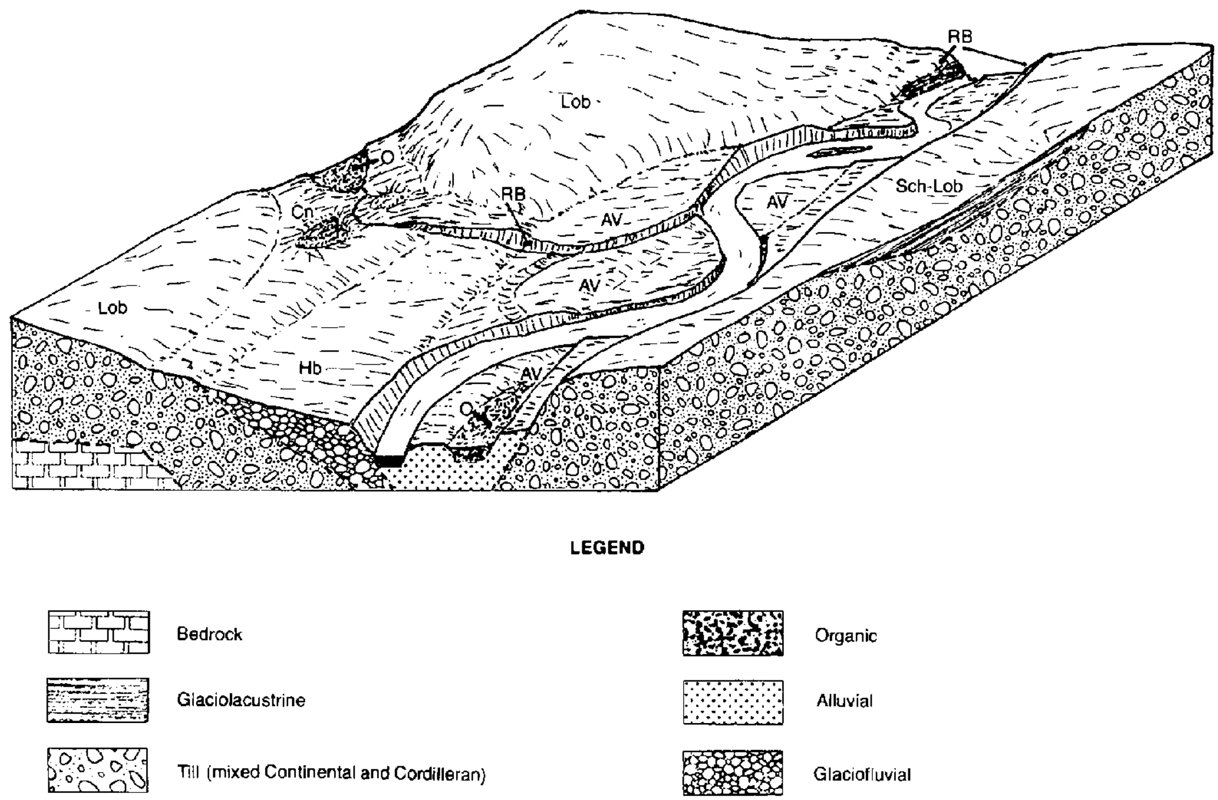


Fig. 16. Block diagram illustrating undifferentiated land units (AV, RB, Organic).

General soil patterns

The soils of the Outer Foothills are dominantly Podzolic Gray Luvisols developed on loamy till (Stolberg—Stb soils). The till occurs as a veneer or blanket over the folded, ridged bedrock, which is frequently exposed. A thin silty veneer overlies the till in much of the area. Soils developed on the veneered tills are Brunisolic Gray Luvisols (Nordegg—Ndg soils) which occur as significant inclusions in Stolberg soil units. Organic and Gleysolic soils occupy narrow valleys between the ridges. Soils developed on bedrock (Maskuta—Msk soils) occur mostly on upper slopes where drift cover is discontinuous.

3.7 DESCRIPTIONS OF THE SOIL UNITS AND UNDIFFERENTIATED LAND UNITS

In this section of the report, each soil combination that appears on the map is briefly described in terms of materials, landforms, vegetation, climate, and soil classification. In addition there are several units which were separated entirely on the basis of their unique landform with no subdivisions based on soil characteristics. These are called undifferentiated land units and include AV, RB, and O (Fig. 16).

The soil and land units are listed in alphabetical order. The areal extent of each unit (Table 4) gives some indication of their relative importance.

AV LAND UNIT (32 550 ha)

The AV land unit is used to describe soils on floodplains of streams and rivers (Figs. 16 and 17). The materials tend to be sands, silts, and gravels, and the

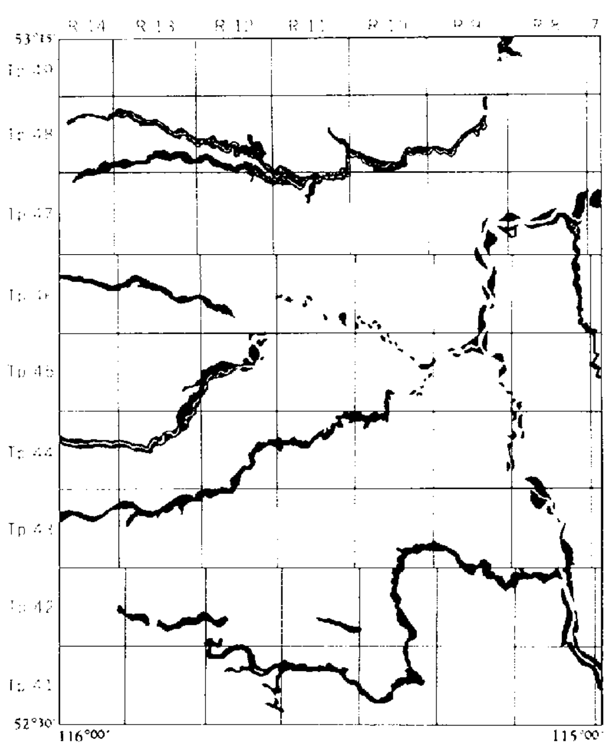


Fig. 17. Distribution of AV land unit.

Table 4. Areal extent of soil units and undifferentiated land units

Unit	ha	% of area
AV	32 550	5.8
Ca1	1 870	0.3
Ca2	18 170	3.2
Ca3	10 020	1.8
Ca4	3 590	0.6
Ca-Lob	1 420	0.3
	35 070	6.2
Cn	6 890	1.2
Ht1	12 760	2.2
Ht-Kz	10 430	1.9
	23 190	4.1
Hb	3 250	0.6
Hub1	41 040	7.4
Hub2	20 410	3.6
Hub3	6 850	1.2
Hub-Mw	1 740	0.3
	70 040	12.5
(Lob-Sch)1	49 650	8.9
(Lob-Sch)2	3 830	0.7
Lob-Sch-O	8 600	1.5
Lob-Sch-Msk	12 380	2.2
	74 460	13.3
Ml1	1 200	0.2
Mw1	7 110	1.3
Mw2	25 990	4.6
Mw3	6 100	1.1
Mw-Ca	11 160	2.0
	50 360	9.0
O	94 010	16.7
Pc1	2 540	0.4
Pc2	7 210	1.3
	9 750	1.7
Rv	3 230	0.6
RB	22 660	4.0
Sch1	4 110	0.7
Sch2	2 950	0.5
Sch-Lob	4 520	0.8
Sch-Lob-O	14 170	2.6
	25 750	4.6
Stb-Ndg	2 280	0.4
Stb-Kz	3 510	0.6
Stb-Ndg-Msk	37 350	6.7
	43 140	7.7
To	5 660	1.0
Wld-Sch	29 370	5.2
Wld-Sch-Msk	11 530	2.0
(Wld-Msk)1	10 490	1.9
(Wld-Msk)2	3 820	0.7
	55 210	9.8
Water	5 130	0.9
		99.9
TOTAL:	561 550	

soils are predominantly Regosolic. Many of the soils are subject to annual flooding and may experience high seasonal water table levels, depending on their position in the landscape. Willows, black spruce, white spruce, balsam poplar, and white birch are the most common trees growing on these soils.

Most of the AV lands are in native vegetation cover and provide important winter habitats for ungulates. The soils have been cleared and cultivated in a few areas where higher terraces are more suitable for agricultural use. The flooding hazard and high water table levels of most of the soils severely limit facility-oriented land uses.

CAROLINE SOIL UNITS (35 070 ha)

The Caroline (Ca) soil units are dominated by Brunisolic Gray Luvisols on materials of silt loam to fine sandy loam texture.

Location in the landscape

Caroline soil units are of widespread occurrence (Fig. 18), especially in the western portion of the Brazeau Plain and on the Crimson Lake Plain. The soils occur on undulating to gently rolling topography, and usually in freely drained positions on slopes (Fig. 19).

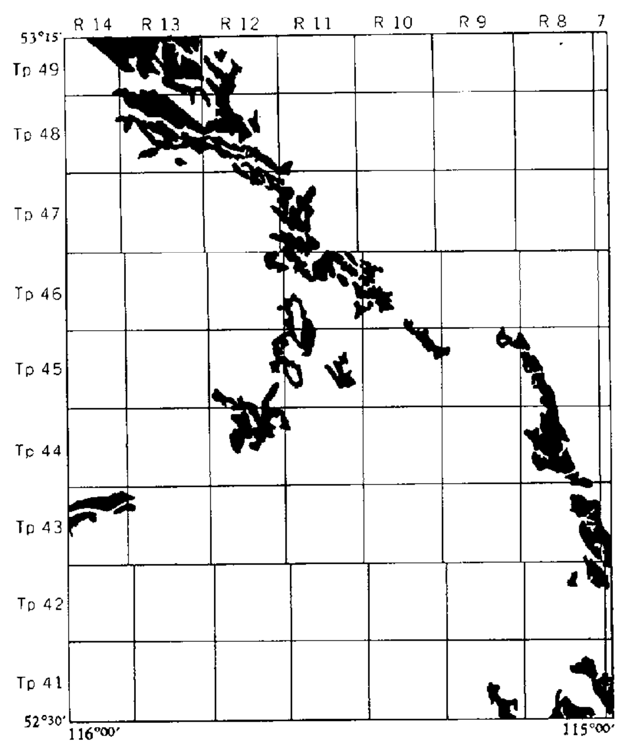


Fig. 18. Distribution of Caroline soil units.

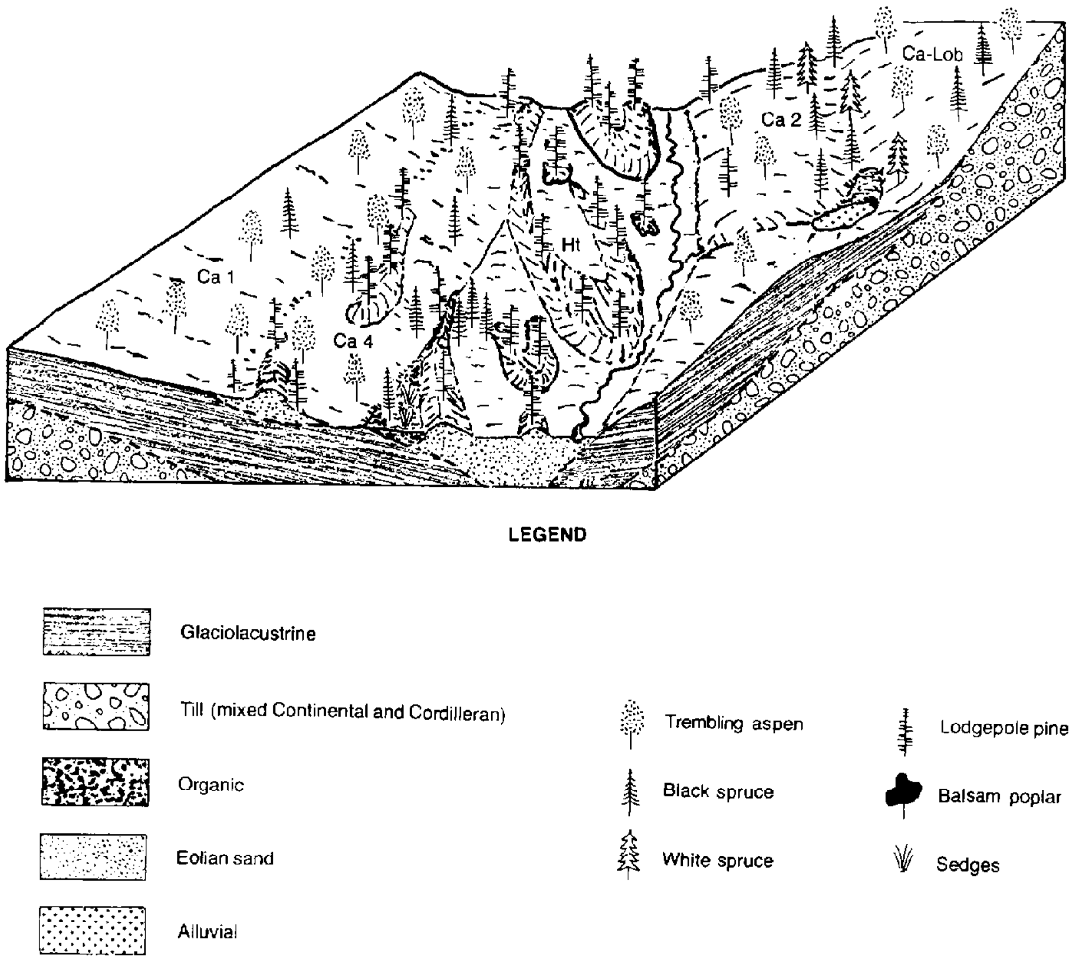


Fig. 19. Block diagram of Caroline soil units.

Landforms and materials

During deglaciation, fine sandy and silty sediments were deposited by glacial meltwater near the margins of lakes formed to the west of the retreating continental ice sheet. In many instances, these sediments were later re-sorted by wind. Thus, the soils occur on deep deposits of sediments, and on blankets and shallow veneers covering till deposits. The veneers and blankets may be wind-deposited in some areas. The land surface is gently undulating in lowland areas, but reflects the shape of the underlying rolling morainal deposits in upland areas. The materials are free from stones, strongly calcareous, and rapidly permeable. In some of the soil units there are inclusions of sandier materials (Culp, and Prentice soils in Ca3 and Ca4).

Soils-climate-vegetation

Due to the permeable nature of silt and very fine sand, moisture is removed fairly rapidly in relation to supply. Trembling aspen, lodgepole pine, and lodgepole pine–black spruce communities usually regenerate on these soils after fire. White spruce may form the climax community; however, the soils tend to be somewhat droughty for white spruce (site index 55–75). The soils are mainly Brunisolic Gray Luvisols, Caroline soils (Plate II*a*). Frost-free period is approximately 60 days, but frost pooling occurs in some of the low areas. May-to-September precipitation is approximately 350–400 mm.

CODNER SOIL UNIT (6890 ha)

The Codner (Cn) soil unit has a dominance of poorly drained Orthic Humic Gleysols on fine sandy and silty materials.

Location in the landscape

Codner soils occur in poorly drained landscape positions, usually in depressions or on level areas in valley bottoms. These soils are confined to the Brazeau Plain, usually occurring near the edge of the plain where seepage waters discharge from the adjacent uplands. Codner soils are abundant in the Elk River area (Fig. 20).

Caroline soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
Ca1	Brunisolic Gray Luvisol (Caroline)	—	well drained	Silty blankets and veneers over undulating to rolling moraines; mid to upper slopes	Lodgepole pine, trembling aspen
Ca2	Brunisolic Gray Luvisol (Caroline)		well drained	As above	As above
		Orthic Humic Gleysol (Codner)	very poorly to poorly drained	Depressions, swales, level areas	Willow, black spruce, sedges
Ca3	Brunisolic Gray Luvisol (Caroline)	Orthic Gray Luvisol (Tolman and some Culp)	well drained	Silty and sandy blankets and veneers over undulating to rolling moraines; mid to upper slopes	Lodgepole pine, trembling aspen
Ca4	Brunisolic Gray Luvisol (Caroline)	Brunisolic Gray Luvisol (Prentice)	well drained	Silty and sandy blankets and veneers over moraines	Lodgepole pine, lodgepole pine–black spruce
Ca-Lob	Brunisolic Gray Luvisol (Caroline)	Brunisolic Gray Luvisol (Lobley)	well to moderately well drained	Discontinuous silty veneers over rolling moraines with till exposures	Lodgepole pine, lodgepole pine–black spruce

Codner soil unit

Soil unit	Dominant soil	Significant soil	Drainage	Landform and landscape position	Vegetation
Cn	Orthic Humic Gleysol	—	poorly drained	Undulating glaciofluvial and glaciolacustrine silts and fine sands	Willow–grass, black spruce, white spruce

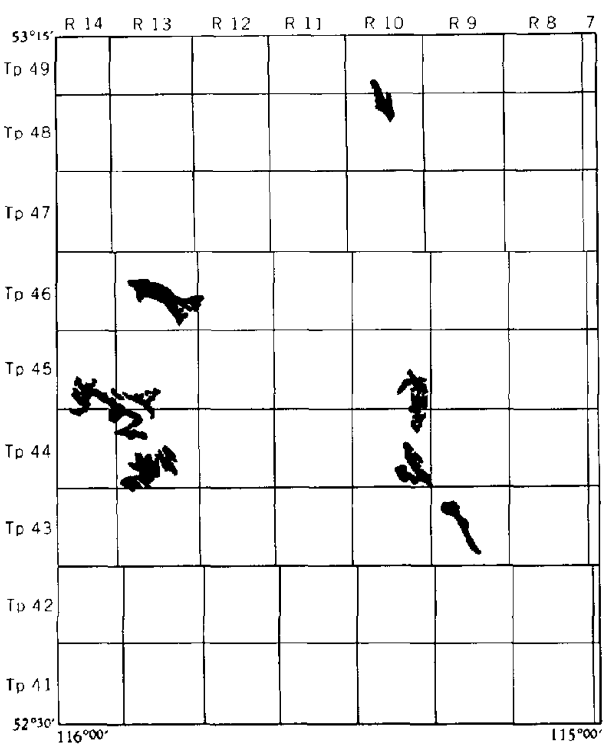


Fig. 20. Distribution of Codner soil units.

Landforms and materials

Codner soils have developed on glaciofluvial and glaciolacustrine silts and fine sands that were deposited near the edge of glacial lakes. These are the same materials the Caroline soils are developed on and the two soils usually occur together, being differentiated by drainage. The materials are often stratified into finer and coarser layers, and are stone-free and strongly calcareous.

Soils-climate-vegetation

Water is removed from these soils slowly in relation to supply. The water table is often near the surface for at least part of the year. The high water content and location in frost-pooling depressions and valley bottoms result in low mean annual soil temperatures.

The soils are typically Orthic Humic Gleysols with thick, very dark brown to black Ahg horizons overlying weakly developed Bg horizons and a Ckg that is strongly to moderately calcareous.

The vegetation associated with these soils is usually a willow shrub-grass community, but may include black spruce or white spruce stands.

Only one Codner soil unit was recognized; it is a fairly homogeneous unit of poorly drained Codner soils.

HEART SOIL UNITS (23 190 ha)

Heart (Ht) soil units have a dominance of Brunisolic soils developed in dune sand.

Location in the landscape

Heart soil units occur on the Brazeau Plain (Fig. 21) at elevations of 850–1000 m in areas where glaciolacustrine and glaciofluvial sands have been blown into dunes (Fig. 22). The interdune areas are often occupied by shallow bogs.

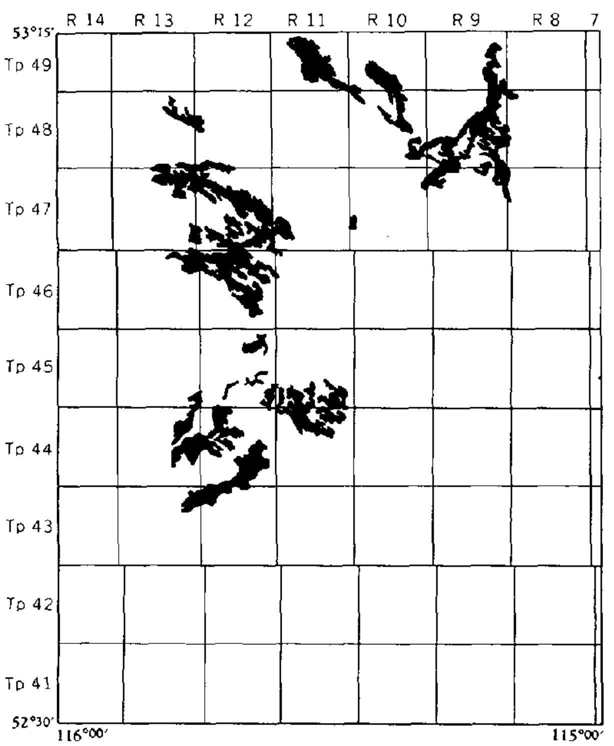


Fig. 21. Distribution of Heart soil units.

Landforms and materials

Dunes form the distinctive landform of the Heart soil units (Fig. 22). They are now treed and no longer active.

Sands deposited near the edge of the postglacial lake were formed into U-shaped and longitudinal dunes by northwesterly winds after the lake receded. The dunes vary in size, with average relief in the range of 3–5 m. Topography is undulating to rolling with long, gentle windward slopes and short, steep lee slopes.

The coarse and medium-sized sands are very rapidly permeable, stone-free, and weakly calcareous.

Soils-climate-vegetation

The sandy dune soils are rapidly permeable with very low capacity for supplying plant-available moisture. Soils located in freely drained positions of the landscape (dune crests) are droughty. Plant communities are usually dominated by lodgepole pine which regenerates after fire and forms an edaphic climax. If the vegetation is removed and the dune disturbed, such as in road construction, it is extremely difficult to revegetate the exposed area.

The soils are predominantly Eluviated Eutric (base-rich) and Dystric (base-poor) Brunisols (Plate II*b*). In some of the Heart soils there are significant accumulations of clay in the subsoil (Gray Luvisols). Also included are occasional soils that have strongly colored B horizons with significant contents of iron and aluminum (Humo-Ferric Podzols). Water tables are often near the surface in the interdune areas and Gleysolic soils are common minor inclusions in both the Ht1 and Ht-Kz units.

Drainage systems are poorly integrated in dune fields and shallow bogs form in the interdune areas. These are black spruce–sphagnum bogs with Mesisol (Kenzie) soils included in the Ht-Kz soil unit.

HORBURG SOIL UNIT (3250 ha)

The Horburg (Hb) soil unit has a dominance of Brunisolic and Podzolic Gray Luvisols on gravelly glaciofluvial materials.

Location in the landscape

Horburg soils are of limited areal extent (Fig. 23), occurring in isolated locations adjacent to stream channels. These soils occur at elevations near 1000 m, mainly in the southern portion of the map sheet in the Crimson Lake Plain and the O'Chiese Upland.

Landforms and materials

The gravelly and sandy glaciofluvial materials in which these soils have developed were deposited as outwash and as ice-contact deposits. Most of them are located on fluvial terraces. The gravelly sands are usually capped with a thin veneer of nongravelly sand and silt. The materials are rapidly permeable and weakly calcareous. The gravel and cobbles are predominantly quartzites.

Soils-climate-vegetation

The gravelly sands of the Horburg unit are rapidly permeable and hold very little plant-available moisture. Lodgepole pine or lodgepole pine–black spruce communities regenerate on these soils and form an edaphic climax.

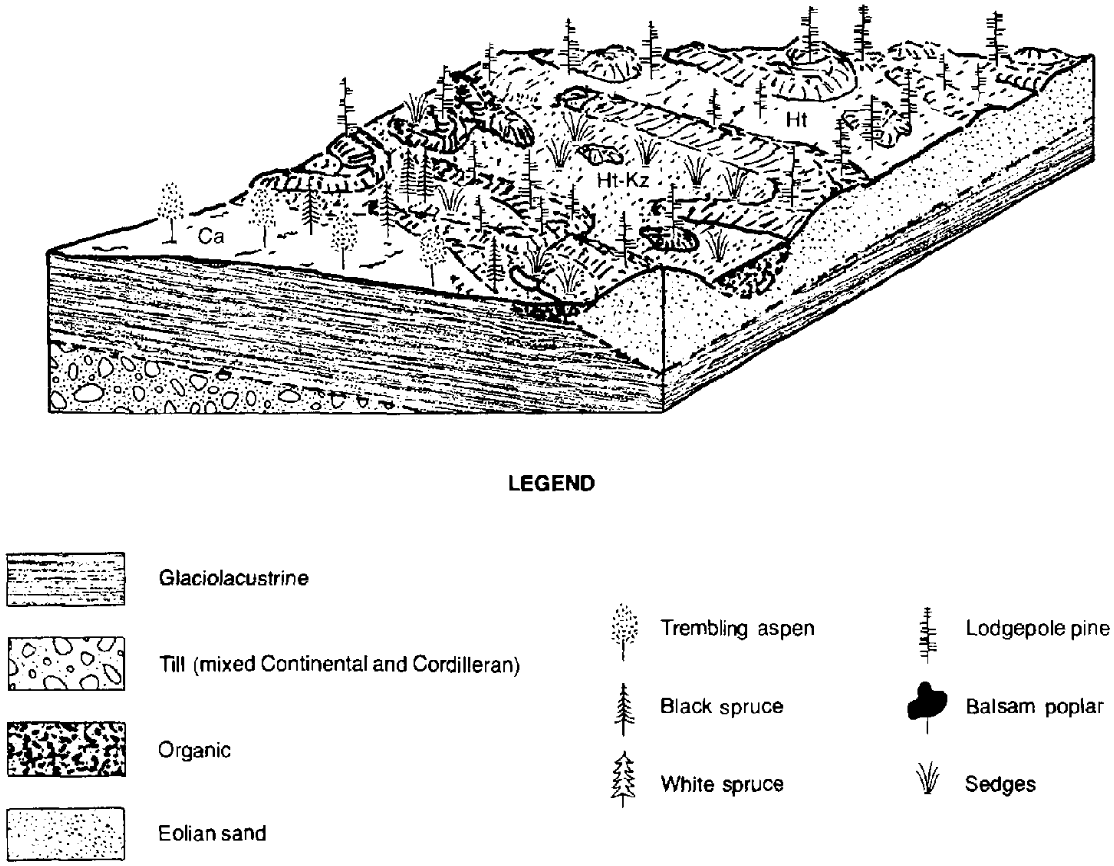


Fig. 22. Block diagram of Heart soil units.

Heart soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
Ht1	Eluviated Dystric and Eutric Brunisols	Orthic Gray Luvisol	rapidly drained	Sand dunes	Lodgepole pine, lodgepole pine-black spruce
Ht-Kz	Eluviated Dystric and Eutric Brunisols		rapidly drained	Sand dunes with bogs in interdune areas	Lodgepole pine
		Terric Mesisols	very poorly drained		Black spruce-sphagnum

Horburg soil unit

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
Hb	Brunisolic Gray Luvisol (Horburg)	Podzolic Gray Luvisol and Eluviated Eutric Brunisol	rapidly drained	Glaciofluvial outwash plain and kame terraces	Lodgepole pine, lodgepole pine-black spruce

The soils are dominantly Brunisolic Gray Luvisols with a sequence of L-F, Ae, Bm, Ae, IIBt, and IICk horizons. There are some Podzolic Gray Luvisols with a more strongly developed upper sequence and some Eluviated Eutric Brunisols where the IIBt horizons are only weakly expressed. The upper sola of these soils are strongly acid but the underlying gravels are calcareous.

Tree roots are concentrated in the upper few centimetres of finer textured materials where most of the water is held. This shallow rooting results in a high windthrow hazard for trees on these soils.

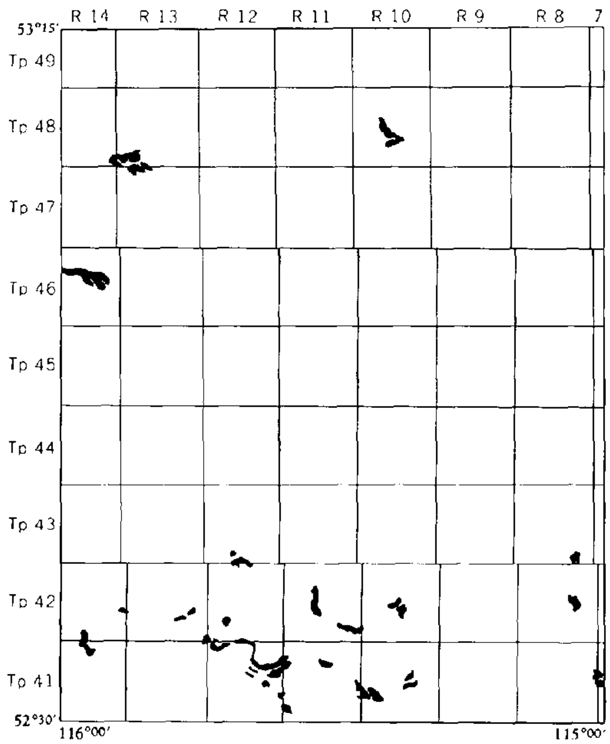


Fig. 23. Distribution of Horburg soil unit.

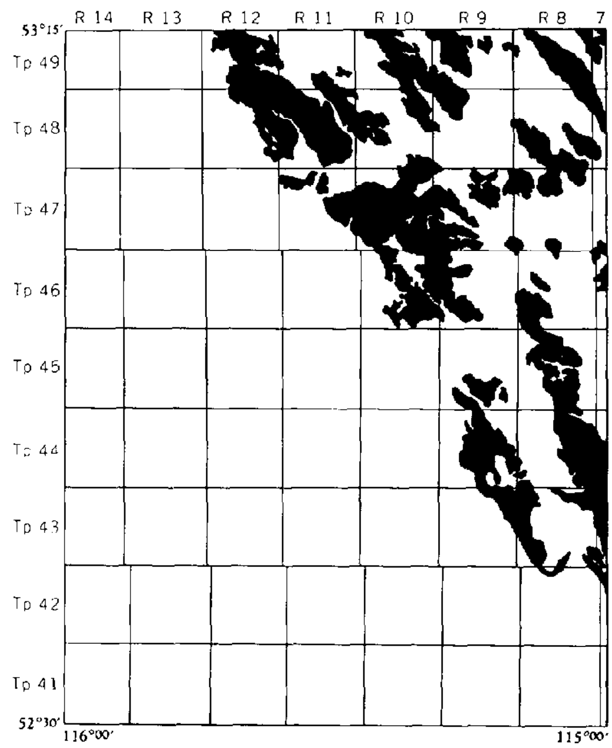


Fig. 24. Distribution of Hubalta soil units.

HUBALTA SOIL UNITS (70 040 ha)

The Hubalta (Hub) soil units have a dominance of Orthic Gray Luvisols on clay loam textured till of continental origin.

Location in the landscape

Hubalta soils occur in the Buck Lake Upland and on outliers of the uplands above the elevation of glaciolacustrine sediments (approximately 970 m) in the Crimson Lake and Brazeau plains (Fig. 24). The topography is undulating to rolling. Gleysolic and Organic soils occupy the depressional areas in the landscape (Fig. 25).

Landforms and materials

Morainal landforms of the Buck Lake Upland are composed of clay loam textured till deposited by the continental ice sheet. The till is olive brown, slightly to moderately stony, moderately to slowly permeable, and weakly to moderately calcareous. The till is underlain by Tertiary-Cretaceous-aged Paskapoo sandstones which may be quite hard or fairly soft. Depth to bedrock is variable, with till thickness ranging from about 1 m on ridge crests to greater depths on lower slope positions. The surface form of the flat-lying bedrock controls much of the landscape.

Glaciolacustrine clays, silts, and fine sands occur to elevations of approximately 970 m, and often overlie the lower morainal ridges as discontinuous veneers and blankets.

Soils-climate-vegetation

Hubalta soils are characterized by strongly developed Luvisolic features. The strongly eluviated, light gray, platy Ae horizons overlie firm, blocky Bt horizons with thick coatings of illuviated clay on the ped surfaces.

The eluvial horizons often have a lighter colored upper subhorizon (Ae1) and a yellowish brown lower subhorizon (Ae2). Soils with this horizon sequence are sometimes referred to as "bleached" Orthic Gray Luvisols. In this report these soils are grouped with the Hubalta soils.

Trembling aspen usually regenerates on these moderately well drained soils and forms a seral stage in a succession to white spruce. Site index for white spruce is 75±10 (Lesko and Lindsay 1973) and for lodgepole pine is 68±7. Imperfectly drained soils occur on lower slopes in depressional areas, and in areas of seepage or ponding. Balsam poplar occurs on Gleyed Gray Luvisol (Bremay) soils in these areas.

Plant roots are concentrated in the thin surface organic layers (duff) and in the Ae. The Ae horizons have low moisture-holding capacity, and when exposed by activities such as cultivation or scarification, they often puddle when wet and form a hard crust on drying. The Bt horizons tend to be fairly dense and slowly permeable to water.

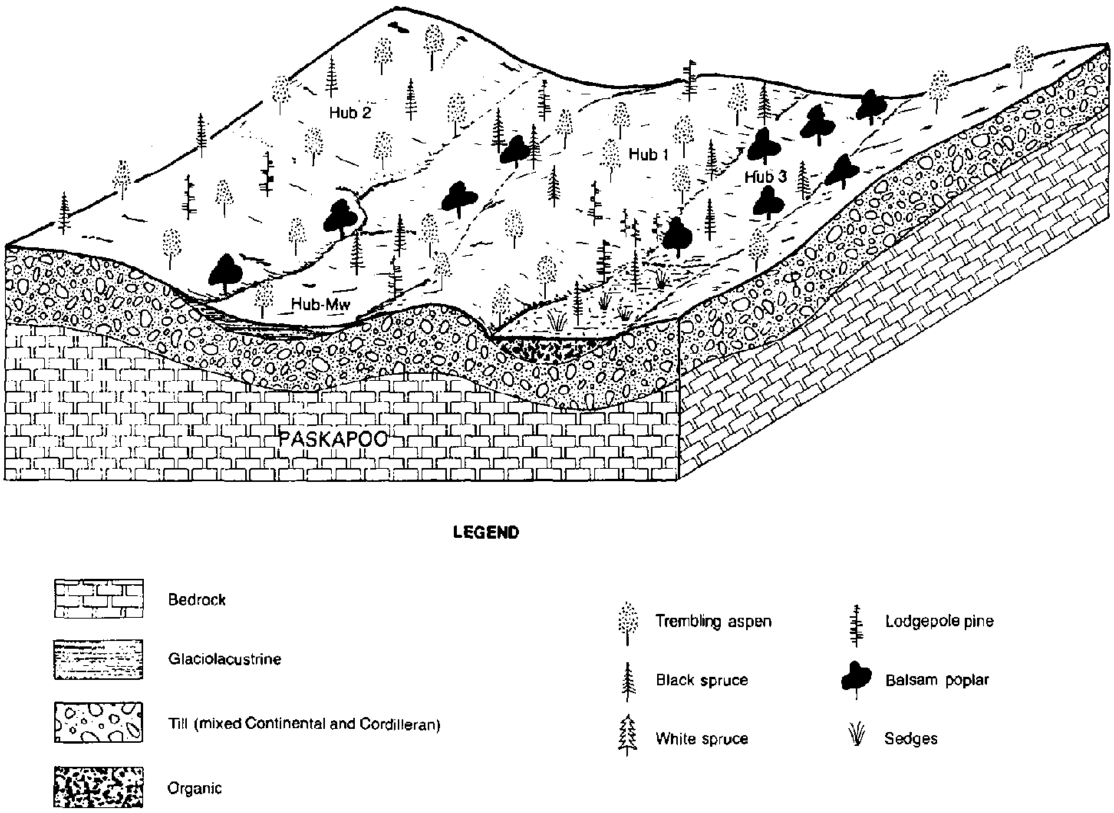


Fig. 25. Block diagram of Hubalta soil units.

Hubalta soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
Hub1	Orthic Gray Luvisol (Hubalta)		moderately well drained	Upper slopes of rolling and undulating moraines	Trembling aspen, pine, white spruce
		Gleyed Gray Luvisol (Bremay) up to 10% Gleysolics	imperfectly to very poorly drained	Lower slopes, depressional areas, and seepage areas	Balsam poplar, black spruce, willow, birch
Hub2	Orthic Gray Luvisol (Hubalta)		moderately well drained		Trembling aspen, pine, white spruce
		Gleyed Gray Luvisol (Bremay) and	imperfectly drained		Balsam poplar
		Podzolic Gray Luvisol (O'Chiese)	moderately well drained		Lodgepole pine
Hub3	Gleyed Gray Luvisol (Bremay)		imperfectly drained	Undulating moraines, often lower slopes	Balsam poplar
		Dark Gray Luvisol (Dekalta)	moderately well to imperfectly drained		Trembling aspen
Hub-Mw	Orthic Gray Luvisol (Hubalta)	Orthic Gray Luvisol (Maywood)	moderately well drained	Discontinuous lacustrine veneers over lower slopes and low knolls	Trembling aspen, white spruce, some pine

LOBLEY SOIL UNITS (74 460 ha)

Lobley (Lob) soil units have a dominance of Brunisolic Gray Luvisols on loamy till of mixed (Cordilleran and continental) origin.

Location in the landscape

Lobley soil units cover most of the rolling morainal O'Chiese Upland (Fig. 26). These soils are found in freely drained, upland positions in association with Sunchild and Maskuta soils (Fig. 13).

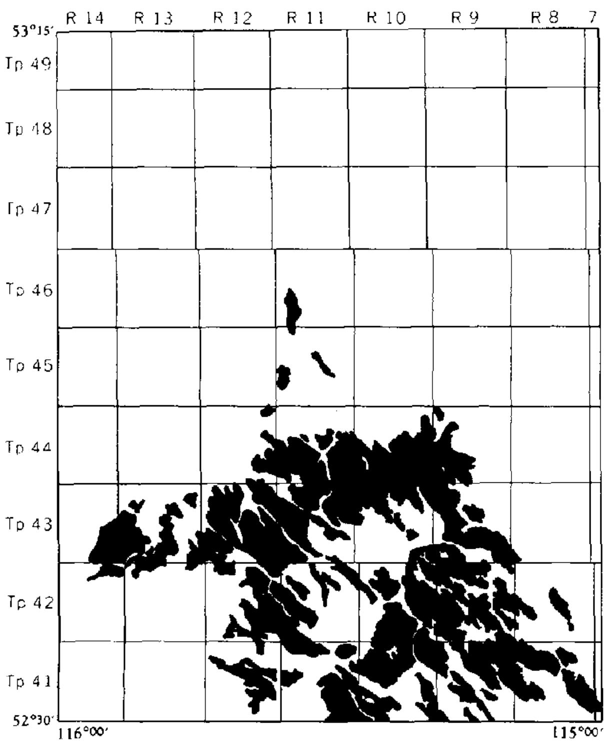


Fig. 26. Distribution of Lobley soil units.

Landforms and materials

Lobley soil units occur on loamy till blankets and veneers covering bedrock of the Paskapoo formation. There are discontinuous silty veneers over the till in much of the landscape, with occasional sandstone outcrops. The till is moderately stony and moderately permeable. The sandstone is usually quite soft (it could be ripped by a bulldozer), but it has hard layers and lenses. Topography of Lobley soil areas is rolling to ridged with short, steep slopes.

Soils-climate-vegetation

Well drained soils are dominant in Lobley soil units, but poorly drained Gleysolic and Organic soils are significant inclusions in valley bottoms.

Lobley soil units occur on the O'Chiese Upland which has a cool climate. The short frost-free period, generally less than 60 days, is extremely limiting for agricultural production. The May-to-September precipitation is approximately 450 mm. The soils are associated with lodgepole pine, lodgepole pine-black spruce, and white spruce communities. Trembling aspen communities occur occasionally.

The Lobley soils have a horizon sequence of L-F, Ae, Bm, Bt, and Ck, typical of Brunisolic Gray Luvisols. The Bm in the upper solum may occasionally contain sufficient iron and aluminum oxides to qualify as a Bf, and the soil would then be classified as a Podzolic Gray Luvisol.

The (Lob-Sch)1 unit indicates areas of predominantly Lobley soils (Brunisolic Gray Luvisols on loamy till) with 20-40% inclusions of Sunchild soils (Brunisolic Gray Luvisols on silt loam blankets).

The (Lob-Sch)2 unit is similar to (Lob-Sch)1, but includes 10-20% Gleysolic soils. The Lob-Sch-O unit includes 10-20% Organic (Kenzie) soils on bogs rather than Gleysols. The Lob-Sch-Msk unit describes hilly, ridged landscapes where Brunisolic soils on sandstone bedrock (Maskuta soils) are associated with Lobley and Sunchild soils.

Lobley soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
(Lob-Sch)1	Brunisolic Gray Luvisol (Lobley)	20-40% Brunisolic Gray Luvisol (Sunchild)	well drained	Loamy till with discontinuous silty veneers and blankets plus blanket bogs	Lodgepole pine, lodgepole pine-black spruce
(Lob-Sch)2	Brunisolic Gray Luvisol (Lobley)	20-40% Sunchild plus	well drained		As above
		10-20% Gleysolics	poorly drained		Black spruce
Lob-Sch-O	Brunisolic Gray Luvisol (Lobley)	20-40% Sunchild plus	well drained		Lodgepole pine, lodgepole pine-black spruce plus black spruce-Labrador-tea-sphagnum bogs
		10-20% Organic (Kenzie)	very poorly drained		
Lob-Sch-Msk	Brunisolic Gray Luvisol (Lobley)	Brunisolic Gray Luvisol (Sunchild) plus Eluviated Eutric Brunisol (Maskuta)	well drained	Loamy till with silty veneer blanketing ridged and rolling sandstone; occasional sandstone outcrops	Lodgepole pine, lodgepole pine-black spruce

MACOLA SOIL UNIT (1200 ha)

The Macola (Ml) soil unit has a dominance of Dark Gray Luvisols and glaciolacustrine clays (same materials as Maywood and Raven soil units).

Location in the landscape

The Macola soil unit occurs only in the extreme northeastern corner of the map area (Fig. 27). The soils occur on glaciolacustrine clays below elevations of 970 m in association with Maywood and Raven soils.

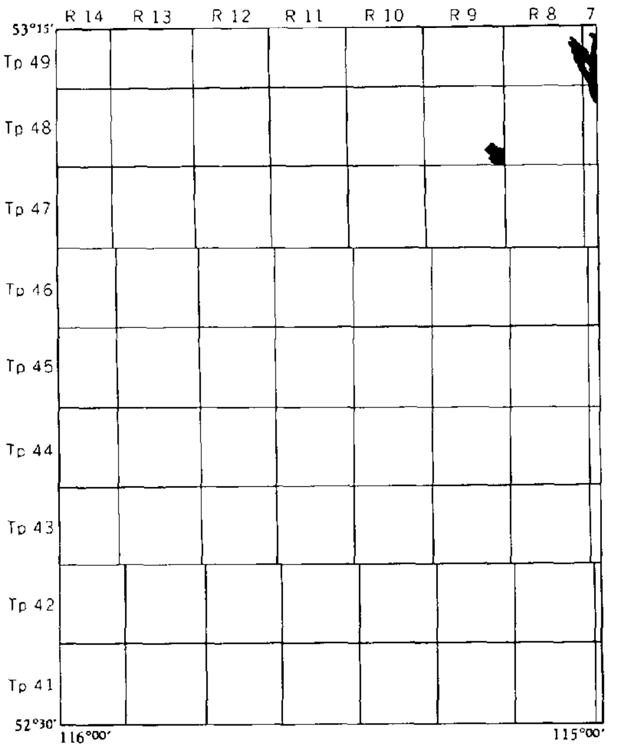


Fig. 27. Distribution of Macola soil unit.

Landforms and materials

The Macola soil unit occurs on the same landforms and parent materials as Maywood soils.

Soils-climate-vegetation

Macola soils have Ah horizons, indicating a significant grass cover during soil development. These soils tend to occur on lower slopes and are moderately well to imperfectly drained. The soils probably developed under willow shrub-grass vegetation. These are the most suitable soils in the map area for agriculture.

The Dark Gray Luvisols are intimately mixed with Orthic Gray Luvisols (Maywood soils) and Gleysols—peaty phase (Prestville soils). Only one M l soil unit was recognized.

MAYWOOD SOIL UNITS (50 360 ha)

Maywood (Mw) soil units have a dominance of Orthic Gray Luvisols formed on glaciolacustrine clays.

Location in the landscape

Maywood soils occur in the lowland areas of the Brazeau Plain in the northeastern corner of the map area (Fig. 28). The glaciolacustrine clays these soils are formed on occur below 970 m. The topography varies from level and undulating to gently rolling where the clays blanket underlying moraines (Fig. 29).

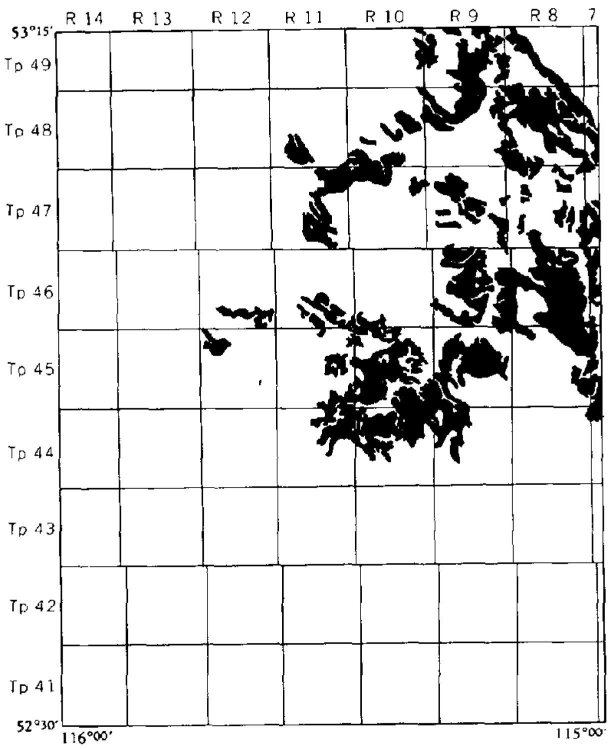


Fig. 28. Distribution of Maywood soil units.

Landforms and materials

The Maywood soils are formed on fine textured sediments deposited in lakes formed by the ponding of glacial meltwaters. The deposits of predominantly clay- and silt-sized sediments vary in thickness, but are generally less than 2 m and often less than 1 m thick. The underlying material is usually till. The clayey materials are very slowly permeable, highly plastic, usually stone-free, and weakly calcareous.

Soils-climate-vegetation

Trembling aspen is the most common tree species to regenerate on the moderately well drained soils after fire, being seral to white spruce climax. Lodgepole pine may regenerate in areas where there is a good seed

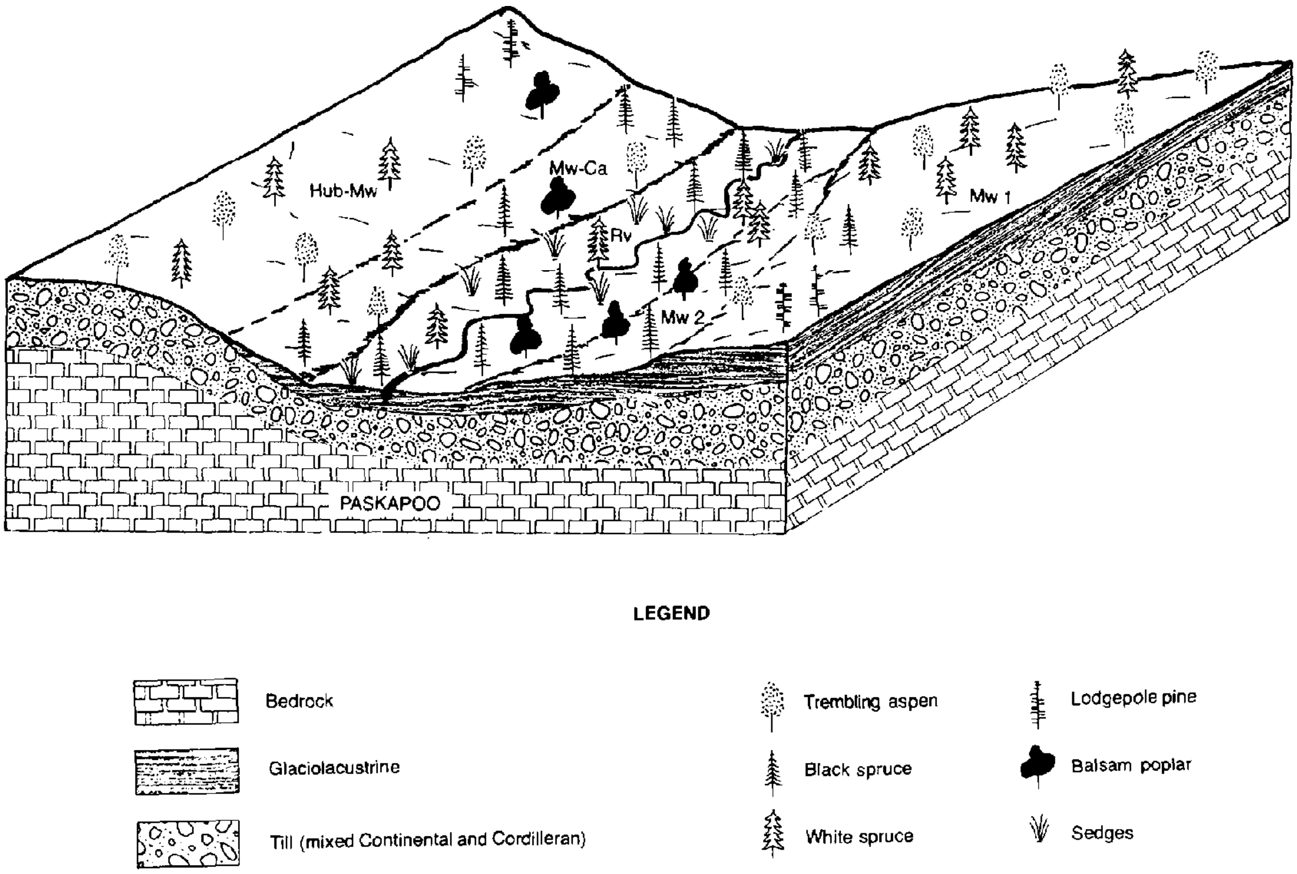


Fig. 29. Block diagram of Maywood soil units.

source. Willow shrubs and balsam poplar regenerate on the imperfectly drained members of the soil unit and black spruce regenerates and forms a climax on the poorly drained soils. Site index on the moderately well drained Maywood soils is about 75, increasing to about 83 on poorly drained (Raven) soils. Site index for lodgepole pine is about 75 on the moderately well drained soils but the poorly drained soils are nonproductive for pine.

Some Maywood soils are being used for agricultural production (mostly forage crops, and some coarse grains) on the eastern edge of the area. Climate and soil characteristics produce severe limitations to crop production. The frost-free period is about 60–75 days, but frost pooling can occur in many of the low areas, especially adjacent to bogs. May-to-September precipitation is approximately 350–400 mm.

The moderately well drained members of the unit (Maywood soils) have strongly leached, light gray, silt loam textured Ae horizons overlying firm, dark gray, strongly structured Bt horizons. The B horizons are very slowly permeable because of their dense structure and high clay content. The slow permeability, combined with gently sloping topography and slow surface drainage, results in a high proportion of imperfectly and poorly drained soils. The imperfectly drained Gleyed Gray Luvisols (Evansburg soils) are saturated early in the growing season and water is generally removed very slowly in relation to supply. These soils have strongly mottled Ae horizons and weakly mottled Bt horizons. The poorly drained Gleysolic soils (Raven and Prestville) have a high water table all year, and often have thin peat surface layers. When disturbed by activities such as road construction, Maywood soils are very susceptible to slumping and gully erosion.

These soils grade to Organic (Kenzie and Eaglesham) soils in enclosed depressions.

ORGANIC LAND UNIT (94 010 ha)

The Organic land unit includes soils developed on both fens and bogs. They occur in all land districts (Fig. 30). These soils were not differentiated as to materials or soil development during the mapping program, although they were examined and characterized. The soils can be split into two groups for discussion: (*a*) soils on fens, and (*b*) soils on bogs.

(*a*) ORGANIC SOILS ON FENS (EAGLESHAM SOILS)

Eaglesham (Eg) soil units are fen units. They have a dominance of Mesic Organic soils developed on sedge peat.

Maywood soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
				Glaciolacustrine clays and blanketing moraines; mid to upper slopes	
Mw1	Orthic Gray Luvisol (Maywood)		moderately well drained	Upper to mid slopes	Trembling aspen, pine, White spruce (mixed)
		Gleyed Gray Luvisol (Evansburg) less than 10%	imperfectly drained	Lower slopes	White spruce, balsam poplar
		Gleysolic (Raven and Prestville)	very poorly drained	Depressions	Black spruce, willow, white spruce
Mw2	Orthic Gray Luvisol (Maywood)		moderately well drained	Mid to upper slopes	Trembling aspen, white spruce, lodgepole pine (mixed)
		10-30% Gleysolic (Raven and Prestville)	very poorly drained	Depressions and level areas	Black spruce, willow, white spruce
Mw3	Orthic Gray Luvisol (Maywood)		moderately well drained	Mid to upper slopes	Trembling aspen, white spruce
		Dark Gray Luvisol (Macola)	moderately well to imperfectly drained		
		Gleyed Gray Luvisol	imperfectly drained	Lower slopes	
Mw-Ca	Orthic Gray Luvisol (Maywood)	Brunisolic Gray Luvisol (Caroline)	moderately well drained	Silty and fine sandy veneers and blankets	White spruce, lodgepole pine (some mixed)
		10% Gleysolic (Raven)	very poorly drained		Black spruce, willow

Location in the landscape

Eaglesham soils occur on fens in all land districts of the map area (Fig. 30). They occur in the lowest position of the local landscape, in old drainage channels and depressional areas (Fig. 16).

Landforms and materials

Fens (Plate IIc) are peat-covered or peat-filled areas with a high water table, usually at the surface. The dominant peat materials are formed from sedges and brown mosses ("fen peat"). The waters are nutrient-rich, minerotrophic seepage waters from the surrounding mineral soils. The materials are higher in nutrients and pH than the peat from bogs. The peat is partly decomposed (mesic) to well decomposed (humic).

The peat varies from about 1 m to several metres in depth, but is usually fairly shallow. Some of the fens have a patterned surface morphology (string bogs).

Soils-climate-vegetation

Eaglesham soils are cold and water-saturated, and they exist under anaerobic conditions—conditions favorable for organic materials to accumulate at rates faster than those at which they decompose.

The dominant soils are Mesisols, with peat materials that are at an intermediate stage of decomposition. The peat is composed mostly of sedge (*Carex* spp.) and brown moss (*Drepanocladus* spp.) materials. Typical horizon sequence is Of, Om, Oh. Many of these soils have a shallow depth to mineral material (Terric subgroups) and some of the soils are quite well humified (Humisols). The Terric soils are often associated with Gleysols—peaty phase, especially Prestville and Raven soils.

The vegetation is dominated by sedges (*Carex* spp.). Many of the fens are sparsely treed, especially around the edges, by tamarack and occasionally black spruce.

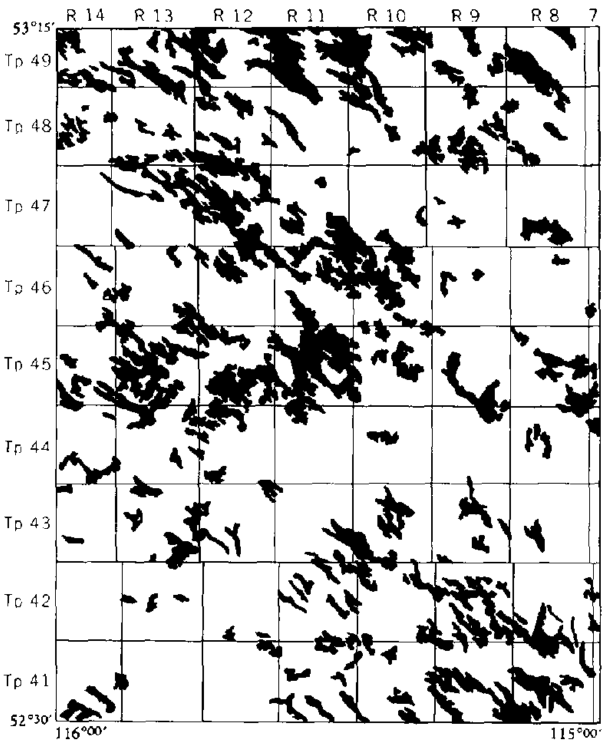


Fig. 30. Distribution of Organic land unit.

(*b*) ORGANIC SOILS ON BOGS (KENZIE SOILS)

Kenzie (Kz) soil units are bog units. They have a dominance of Mesic Organic soils developed on moss or forest peat.

Location in the landscape

Kenzie soils occur in all land districts of the map area (Fig. 30). They usually occur in the lowest portion of the local landscape, in depressions and old drainage channels.

Landforms and materials

Bogs are peat-covered or peat-filled areas, generally with a high water table. The peat is derived from mosses, and the groundwater is acidic and low in nutrients (ombrotrophic). The peat consists dominantly of sphagnum moss with minor amounts of feather mosses, stems and leaves of ericaceous shrubs, and wood from black spruce. The peat is undecomposed (fibric) near the surface and partly decomposed (mesic) at greater depths. The material is usually extremely acid (pH 4.5) and has bulk densities of less than 0.1 g/cm^3. Peat depths vary considerably from less than 1 m to as much as 4 m.

Soils-climate-vegetation

Kenzie soils are cold and water-saturated, and they exist under anaerobic conditions—conditions favorable for organic materials to accumulate at rates faster than those at which they decompose. The most common plant community on these soils is a black spruce-Labrador-tea-sphagnum moss type (Plate II*d*). Tree cover is usually less in the center of the bog.

Frozen layers may persist in shaded areas until midsummer.

Frost pooling occurs in many bog areas that are located in the lower landscape positions. The local climate and soil climate are often more important to plant growth than the regional climate.

PRENTICE SOIL UNITS (9750 ha)

The Prentice (Pc) soil units are composed dominantly of Brunisolic Gray Luvisols on glaciolacustrine and glaciofluvial sands.

Location in the landscape

The Prentice soils are located on the Brazeau Plain and Crimson Lake Plain at elevations of 850–1000 m (Fig. 31). They are found in close association with Caroline (Fig. 19) and Heart soils. Topography is undulating with long, gentle slopes.

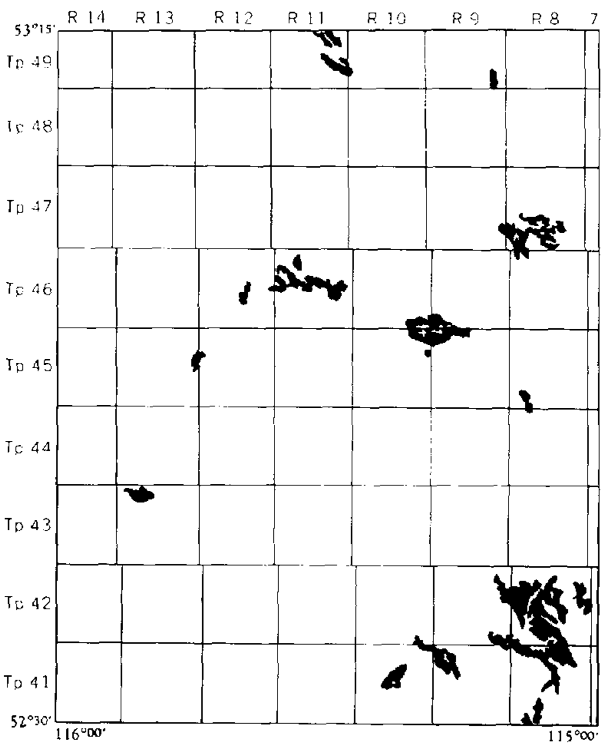


Fig. 31. Distribution of Prentice soil units.

Landforms and materials

Prentice soils have developed on the sandy glaciolacustrine and deltaic sediments deposited near the edge of the glacial lake. The sands are fairly deep (2-3 m) in most of the lacustrine basin, but thin out to veneers and blankets in higher areas of moraines. The materials are often closely associated with silts and fine sands (Caroline units) and in some areas the sands have formed dunes (Heart units). Surface form of the landscape is usually undulating with fairly long, gentle slopes but in some areas Prentice soils occur on low dunes. The sands and loamy sands are rapidly permeable, stone-free, and moderately calcareous.

Soils-climate-vegetation

The sandy textures of these soils result in low supplies of plant-available water and droughty conditions. Lodgepole pine communities (and occasionally trembling aspen) regenerate after fire, and probably form an edaphic climax. Site index for lodgepole pine is about 60.

The soils display surprisingly strong pedogenic development. Brunisolic Gray Luvisols are dominant, but Podzolic Gray Luvisols also occur, especially in the western portions of the Brazeau Plain. The soils have an Ae1, Bm, Ae2 sequence overlying a Bt with a good textural increase. The underlying Ck is strongly effervescent immediately below the Bt, at depths of about 35 cm. The fine loamy Bt horizon probably contributes significantly to the plant-available moisture content. The Pc1 soil unit may also contain some Brunisolic (Heart) soil where dune areas have been included in the unit.

Poorly drained soils in depressional areas are included in the Pc2 soil unit. These are dominantly Orthic Humic Gleysols (Codner soils) which have a high water table most of the summer. Black spruce communities are dominant on these soils.

RAVEN SOIL UNIT (3230 ha)

The Raven (Rv) soil unit consists of poorly drained Orthic Humic Gleysols developed on glaciolacustrine clays and silty clays.

Location in the landscape

Raven soils occur on the Brazeau Plain in the area of glaciolacustrine clays (Fig. 32). These are poorly drained soils occupying depressional and level areas

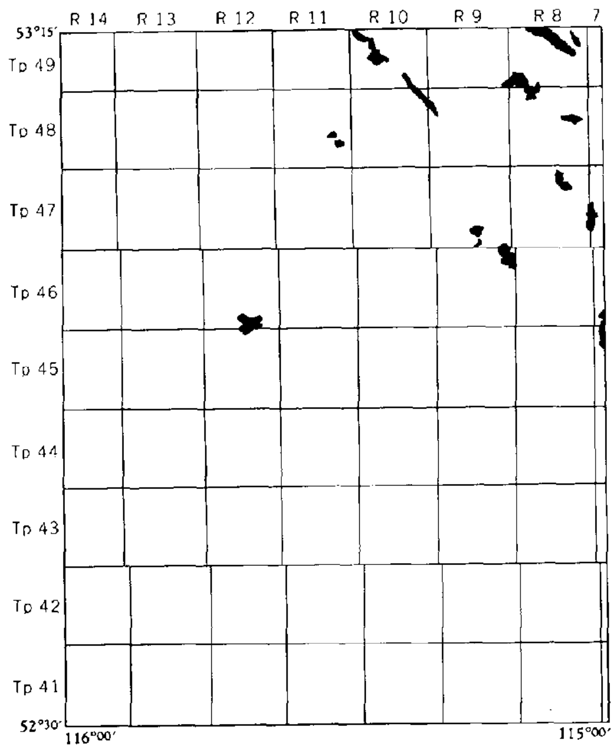


Fig. 32. Distribution of Raven soil unit.

Prentice soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
				Sandy glaciofluvial and glaciolacustrine plains and blankets	
Pc1	Brunisolic Gray Luvisol (Prentice)	Podzolic Gray Luvisol and Eluviated Dystric Brunisol (Heart)	well drained	Mid to upper slopes	Lodgepole pine, lodgepole pine-black spruce, trembling aspen
Pc2	Brunisolic Gray Luvisol		well drained	Mid to upper slopes	Lodgepole pine
		Orthic Humic Gleysol (Codner)	poorly drained	Depressional areas	Black spruce

where runoff waters are ponded or groundwater is discharging. These soils are associated with Macola and Maywood soils, and with Organic soils. The block diagram (Fig. 29) illustrating Maywood soils also shows the landscape position of Raven soils.

Landforms and materials

The landforms and materials associated with the Raven soil unit are the same as those of the Maywood and Macola units. The landforms are usually level to undulating plains. The materials are clays and silty clays of glaciolacustrine origin that are usually stone-free and are very slowly permeable to water.

Soils-climate-vegetation

Raven soils are water-saturated most of the year due to high water tables and ponded runoff waters. Because of the high water content, the soils warm up slowly in the spring and have a low annual soil temperature. These soils are often located in depressions or near bogs where cold air pools, resulting in a cool microclimate with increased frost hazard.

The soils often have a moderately thick layer of peat at the surface overlying a thick, black Ahg horizon. The Ahg has high humus content and generally falls in the silty clay loam to silty clay textural classes. The underlying Bg and Ckg horizons are silty clay to heavy clay. The Bg usually has fine granular (shotty) to massive structure.

White spruce, black spruce, and willow and sedge communities are usually associated with Raven soils. The site index for white spruce is 88±8 (Lesko and Lindsay 1973), which is higher than for other soils in the area.

RB LAND UNIT (22 660 ha)

The RB land unit describes very steeply sloping river banks and stream banks (Fig. 16 and Plate IIe). The materials and soils are highly variable, and have not been separated during the inventory. The stream channels have been eroded through glacial deposits and are often incised into the underlying bedrock. The height of the river banks varies from a few metres to a 100 m on streams like the North Saskatchewan and Brazeau rivers. The glacial deposits include sands, silts, clays, and loam or clay loam textured till.

The materials along the banks are often slumped and tend to be unstable in many areas because of their steepness and the undercutting of slopes by active erosion.

Soils present in this land unit include Regosols, Brunisols, and Luvisols.

The RB lands have severe limitations for facility-oriented uses because of steep slopes and unstable soil conditions. However, they provide important winter habitats for ungulates.

STOLBERG SOIL UNITS (43 140 ha)

Stolberg (Stb) soil units have a dominance of Podzolic Gray Luvisols developed on loamy till located in the Outer Foothills (Fig. 15).

Location in the landscape

Stolberg soil units occur on the steeply sloping, ridged landscape of the Outer Foothills at elevations of 1100–1500 m (Fig. 33).

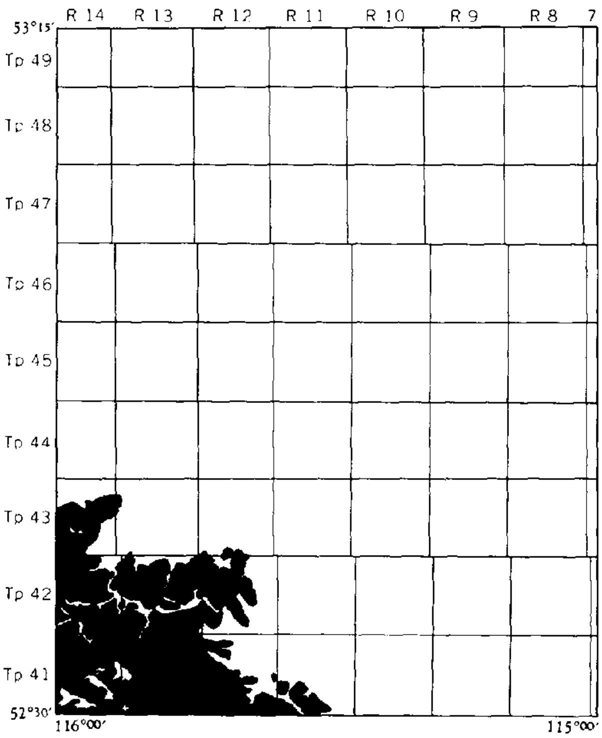


Fig. 33. Distribution of Stolberg soil units.

Raven soil unit

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
Rv	Orthic Humic Gleysol	peaty phases	poorly drained	Depressional and level areas on glaciolacustrine plain	White spruce, black spruce, willow and sedge communities

Landforms and materials

The folded, ridged bedrock of the Outer Foothills is covered by thin blankets and veneers of loamy Cordilleran till and colluvium. These are usually capped by a thin silty veneer. The blankets and veneers are discontinuous, and bedrock outcrops are common. Blanket and bowl bogs occupy the narrow valleys.

Soils-climate-vegetation

The Outer Foothills area has the highest elevations, coolest mean temperatures, shortest frost-free period, and greatest precipitation in the Brazeau Dam area. The frost-free period is highly variable over short distances, but is generally less than 30 days with a probability of frost in every month.

Lodgepole pine and lodgepole pine-black spruce stands form seral stages in succession to white spruce climax. Subalpine fir and white spruce-Englemann spruce are common elements in the boreal-subalpine transitional forest.

The Stb-Ndg soil unit is dominated by Podzolic Gray Luvisols on loamy till (Stolberg soil), with considerable inclusions of Brunisolic Gray Luvisols on silt loam textured veneers overlying the till (Nordegg soil) and up to 10% Gleysolic soils. The Stb-Kz unit is dominantly Stolberg soils with Organic (Kenzie) soils in depressional areas. This unit is used to map areas that contain a considerable amount of poorly drained valley bottoms or plateaus. The Stb-Ndg-Msk unit is similar to the Stb-Ndg unit, but includes Maskuta soils on bedrock (usually sandstone) outcrops. The drift cover is thin in these areas, and the topography is steeply ridged.

SUNCHILD SOIL UNITS (25 750 ha)

Sunchild (Sch) soil units have a dominance of Brunisolic Gray Luvisols developed on silty to loamy materials.

Location in the landscape

Sunchild soil units occur on the margins of the O'Chiese Upland where the silty materials form a fairly thick blanket, and on silty veneers overlying till on the rolling upland areas (Fig. 34). Over much of the Wolf Lake and O'Chiese upland areas, these soils occur on discontinuous veneers that cover less than 50% of the landscape (Figs. 13 and 14). Sunchild soils in these areas are mapped as inclusions in Wildhay and Lobley soil units.

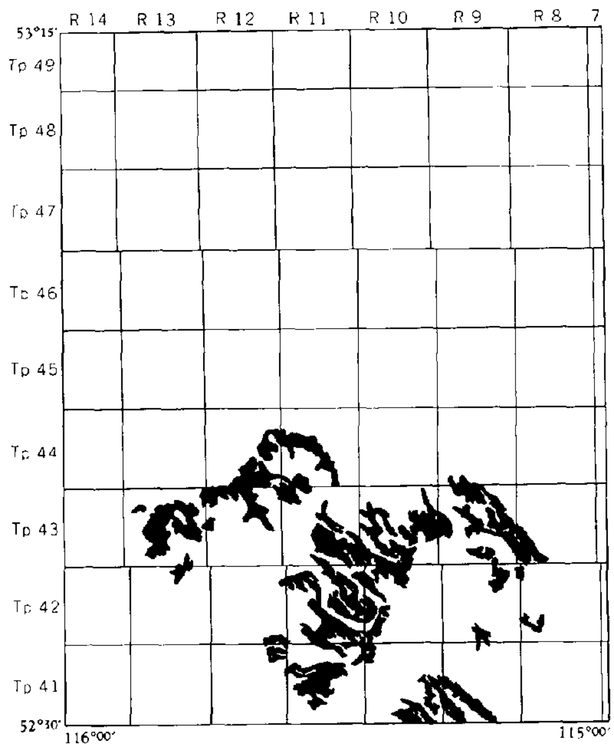


Fig. 34. Distribution of Sunchild soil units.

Stolberg soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
Stb-Ndg	Podzolic Gray Luvisol (Stolberg)	Brunisolic Gray Luvisol (Nordegg)	well drained	Loamy till blankets over ridged bedrock with discontinuous silty surface veneer	Lodgepole pine, lodgepole pine-black spruce, white spruce
		Up to 10% Gleysolics	poorly drained		
Stb-Kz	Podzolic Gray Luvisol (Stolberg)		well drained	Loamy till blankets over ridged bedrock and blanket bogs	Lodgepole pine, lodgepole pine-black spruce
		Mesisols (Kenzie)	very poorly drained		Black spruce-Labrador-tea-sphagnum bogs
Stb-Ndg-Msk	Podzolic Gray Luvisol (Stolberg)	Brunisolic Gray Luvisol (Nordegg)	well drained	Discontinuous loamy till blankets over ridged bedrock with discontinuous silty surface veneer	Lodgepole pine, lodgepole pine-black spruce, white spruce
		Eluviated Eutric Brunisol (Maskuta)	well drained		

Landforms and materials

The landforms and materials of the Sunchild soil units are equivalent to those of Caroline units in the plains districts. The soils are developed on silty to loamy textured glaciofluvial and glaciolacustrine sediments. These materials occur as blankets and thicker deposits on the margins of the uplands, and as veneers and blankets overlying till on the rolling morainal uplands. The materials are usually stone-free and are moderately permeable.

Soils-climate-vegetation

Well drained soils are dominant in Sunchild soil units. However, there are significant inclusions of poorly drained soils in valley bottoms. Lodgepole pine and lodgepole pine-black spruce communities are most common on the well drained soils, with black spruce communities occurring on the poorly drained members.

The Brunisolic Gray Luvisols have a sequence of L-F, Ae1, Bm, Ae2, Bt, and Ck horizons. The Bm in the upper solum may occasionally have sufficient content of iron and aluminum oxides to qualify as a Bf horizon, thus meeting the criteria for a Podzolic Gray Luvisol.

The Sch1 soil unit consists of dominantly Brunisolic Gray Luvisols on silty to fine sandy materials (Sunchild soil) with inclusions (up to 30% of area) of poorly drained Gleysolic soils. This soil unit occurs on the margins of the O'Chiese Upland where the silty materials are relatively thick. The Sch2 soil unit is similar to the Sch1 unit, but contains more sandy textured soils, and only 10% poorly drained soils. The Sch-Lob soil unit consists of Sunchild and Lobley soils occurring on areas of discontinuous silty veneers (which may be wind-deposited) overlying rolling and ridged morainal uplands.

TOLMAN SOIL UNIT (5660 ha)

The Tolman (To) soil unit consists of Orthic Gray Luvisols on glaciolacustrine and glaciofluvial sands and silts.

Location in the landscape

Tolman soils occur on the Brazeau Plain at elevations between 850 and 1000 m (Fig. 35). The soils occur in well drained landscape positions, and are often associated with Heart and Prentice soils in the vicinity of major drainage channels.

Landforms and materials

The landforms and materials of Tolman soils are similar to those of Prentice soil units. The soils are developed on the sands and interlayered silty and clayey sediments deposited near the edge of glacial lakes and morainal or fluvial channels. The materials are usually stone-free, and occur as a thick blanket over till or glaciolacustrine deposits on an undulating to rolling plain.

Sunchild soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
Sch1	Brunisolic Gray Luvisol (Sunchild)		well drained	Silty blankets and thicker deposits overlying till	Lodgepole pine, lodgepole pine-black spruce
		Up to 30% Orthic Humic Gleysol (Codner)	poorly drained		Willow, black spruce, sedges
Sch2	Brunisolic Gray Luvisol (Sunchild)	Orthic Gray Luvisol (Tolman) also Prentice	well drained	As above	Lodgepole pine, lodgepole pine-black spruce
		10% Gleysolics	poorly drained		Willow, black spruce, sedges
Sch-Lob	Brunisolic Gray Luvisol (Sunchild)	Brunisolic Gray Luvisol (Lobley)	well drained	Discontinuous silty veneers and blankets overlying till	Lodgepole pine, lodgepole pine-black spruce
Sch-Lob-O	Brunisolic Gray Luvisol (Sunchild)	Brunisolic Gray Luvisol (Lobley)	well drained	As above with Organic soils in depressions	As above
		Organic (O) soils	very poorly drained		Black spruce-sphagnum

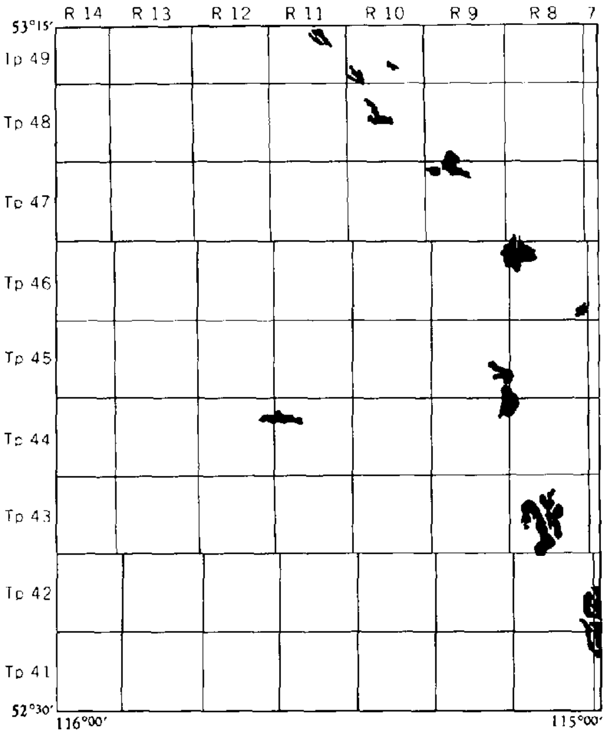


Fig. 35. Distribution of Tolman soil unit.

Soils-climate-vegetation

Tolman soils are well drained because of their landscape position and fairly permeable materials. The loamy textures indicate moderate levels of plant-available moisture. Trembling aspen and lodgepole pine communities regenerate after fire and often form an edaphic climax on these soils. Site index for lodgepole pine is about 60–70.

The soils have sequences of L-F, Ae, Bt, and Ck horizons typical of Orthic Gray Luvisols. The light gray, platy, sandy loam Ae horizons overlie a coarse blocky, sandy clay loam Bt. Textures in the BC when present and the Ck vary from sandy loam to silty clay loam. The Ck occurs at about 1.5 m.

WILDHAY SOIL UNITS (55 210 ha)

Wildhay (Wld) soil units have a dominance of Podzolic Gray Luvisols developed on medium textured till. The parent material of these soils is similar to that of Lobley soils which occur in the O'Chiese Upland.

Location in the landscape

Wildhay soil units occur in the Wolf Lake Upland at elevations of 1000–1200 m. These are the typical soils of the rolling morainal upland area (Fig. 36).

Landforms and materials

The Wildhay soil units occur on morainal blankets and veneers covering rolling to ridged bedrock of the Paskapoo formation. There is a discontinuous silty to fine sandy veneer (probably wind-deposited) over this moraine. The soil-forming materials include loamy till, silty veneers over till, till veneers and blankets over sandstone, and weathered sandstone.

Soils-climate-vegetation

The chemistry and morphology of the Podzolic Gray Luvisols of the Wildhay soil units indicate a cooler, moister climate in the Wolf Lake Upland than in the lower areas to the east.

The area has a short (less than 60 days) frost-free period with a May-to-September precipitation of approximately 450 mm. The short frost-free period is extremely limiting to agricultural production.

Wildhay soil units

Soil unit	Dominant soil	Significant soils	Drainage	Landform and landscape position	Vegetation
Wld-Sch	Podzolic Gray Luvisol (Wildhay)	Brunisolic Gray Luvisol (Sunchild)	well drained	Loamy till and discontinuous silty or fine sandy veneers over loamy till	Lodgepole pine, lodgepole pine-black spruce
Wld-Sch-Msk	Podzolic Gray Luvisol (Wildhay)	Brunisolic Gray Luvisol (Sunchild) Eluviated Eutric Brunisol (Maskuta)	well drained	As above but with some outcrops of sandstone	Lodgepole pine, lodgepole pine-black spruce, occasionally trembling aspen
(Wld-Msk)1	Podzolic Gray Luvisol (Wildhay)	Eluviated Eutric Brunisol (Maskuta)	well drained	Discontinuous loamy till veneers or blankets over sandstone	Lodgepole pine, lodgepole pine-black spruce, occasionally trembling aspen
(Wld-Msk)2	Podzolic Gray Luvisol (Wildhay)	Eluviated Eutric Brunisol (Maskuta)	well drained	As above	As above
		10–20% Gleysolic soils	poorly drained		Black spruce

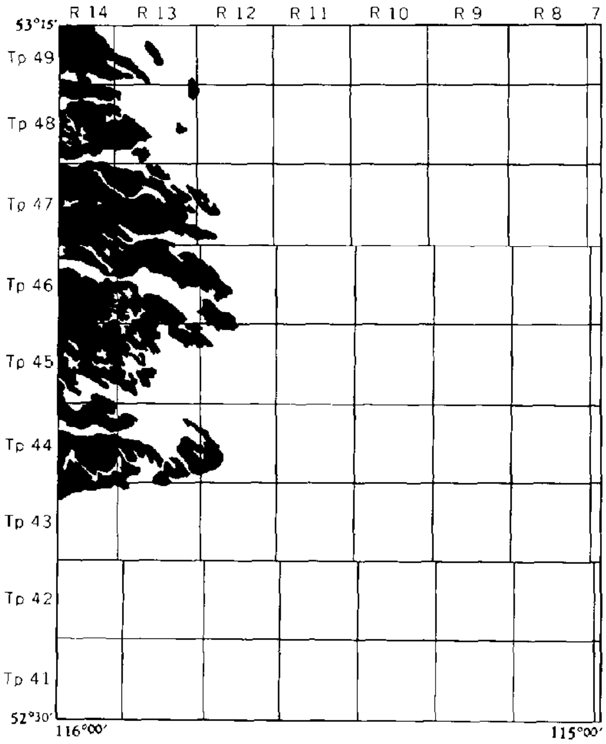


Fig. 36. Distribution of Wildhay soil units.

Lodgepole pine and lodgepole pine-black spruce communities are predominant. Trembling aspen is only sparsely represented. White spruce communities form the normal climax on these soil units.

The Wld-Sch soil unit describes soil areas where Podzolic Gray Luvisols on loamy till (Wildhay soils) are dominant but there is a significant amount of a discontinuous silty veneer (Sunchild soils). The Wld-Sch-Msk unit consists of Wildhay and Sunchild soils with some outcrops of sandstone bedrock. The Maskuta soils are of greater significance in the Wld-Msk soil units. The difference between (Wld-Msk)1 and (Wld-Msk)2 units is the presence of poorly drained soils in the latter unit.

4. SOILS AND LAND USE

Soils and associated attributes of land constitute our most important continuing natural resource. Man depends on land for food and fiber production; as a watershed; as a physical site on which to live, work, and enjoy recreational pursuits; for building materials; and as a place to dispose of garbage and sewage. Misuse of land resources can result in drastic economic, social, and environmental consequences. Sound land use planning must be based on a knowledge of soil properties, soil distribution, and soil performance.

4.1 LAND CAPABILITY FOR AGRICULTURE

Ratings of land capability for agriculture (Table 5) are based on climatic and soil limitations according to the guidelines of the Canada Land Inventory (Canada Land Inventory 1972; Brocke 1977).

Climate is severely limiting in most of the map area because of the short frost-free period. The extreme northeast corner of the map area (Fig. 37) is within climatic subregion 3H (Bowser 1967; Peters 1968; Twardy et al. n.d.), and the remainder of the area is within subregion 5H. Agroclimatic subregion 3H describes areas where the amount of precipitation has usually been adequate, but where it is not considered practical to grow wheat because of the frequency of damaging frosts. The frost-free period averages between 60 and 75 days, and annual precipitation is approximately 450 mm. The best agricultural capability class that can be applied to soils in this climatic subregion is Class 3.

In agroclimatic subregion 5H precipitation is usually adequate, but the frost-free period is so short (generally less than 60 days) that it is impractical to grow cereal crops. Hay crops only are recommended. Mean annual precipitation in these areas is 500–750 mm.

The Canada Land Inventory (CLI) capability classes for agriculture indicate the degree of limitation to agricultural production.

The seven classes are broadly defined as follows:

Class 1 These soils have no significant limitations to use for crops.

Class 2 These soils have moderate limitations that restrict the range of crops or require moderate conservation practices.

Class 3 These soils have moderately severe limitations that restrict the range of crops or require special conservation practices.

Class 4 These soils have severe limitations that restrict the range of crops that can be grown or require special conservation practices to overcome, or both.

Class 5 These soils have very severe limitations that restrict their capability to producing perennial forage crops and improvement practices are feasible.

Class 6 These soils are capable only of producing perennial forage crops and improvement practices are not feasible.

Class 7 These soils or land types have no capability for arable culture or permanent pasture.

Organic (O) Organic soils are not classified in the soil capability for agriculture system.

It must be emphasized that soils within a capability class are similar only with respect to the degree or intensity of limitation, and not the kind of limitation. Each class includes many different kinds of soils, and many of the soils within any one class may require different management practices.

The subclass is a grouping of soils with the same kind of limitation. Different kinds of limitations are recognized as a result of adverse climate, soil, or landscape characteristics. The limiting effects of the climate are considered first since they affect the initial capability class or degree of limitation on a broad subregional basis. Next, the soil and landscape limitations are considered.

4.2 LAND CAPABILITY FOR FORESTRY

The Brazeau Dam area lies in a transitional zone from Boreal to Subalpine forest (Rowe 1972). The forest grades from mixed-wood (aspen–spruce–lodgepole pine) in the lower eastern portion to more purely coniferous (spruce–fir with seral lodgepole pine) in the west and southwest. The main commercial species are white spruce, lodgepole pine, and black spruce.

Climatic and soil factors exert considerable control on forest productivity. The soil units have been grouped into productivity groupings (Table 6) using guidelines established by Dumanski et al. (1972) and Lesko and Lindsay (1973). The groupings in this report are estimates of soil performances, not measured values. The estimates are based on knowledge of soil properties and general climate, and extrapolation of soil–forest productivity data from surrounding areas. Dumanski et al. (1972) related similar soils to growth data in the Hinton–Edson area, and Lesko and Lindsay (1973) established productivity groupings of soil in the Cynthia–Lodgepole area.

Soils and other aspects of land units should be considered in forest management decisions also. Soil and land factors affect forest regeneration, brush hazard, windthrow hazard, and susceptibility of the land to damage during harvesting operations. Estimates of soil performance related to management practices are given in Table 7.

Table 5. Land capability for agriculture

Soil unit	Topography class	Agricultural capability rating: Climatic region 3	Agricultural capability rating: Climatic region 5	Soil unit	Topography class	Agricultural capability rating: Climatic region 3	Agricultural capability rating: Climatic region 5
Ca1	2–4	4D	5C	Mw-Ca	2–4	4D	5C
	5	—	5C	Pc1	2–4	5M	5C
Ca2	2–4	4D5W	5C	Pc2	2–4	5M5W	5C
	5	—	5C	Rv	2–4	5W to 6W	n.a.
Ca3	2–4	4D	5C	To	2–4	4D	5C
	5	—	5C	Sch1	1–5	n.a.	5C
Ca4	2–4	4D5M	5C	Sch2	2–5	—	5C
	5	—	5C	Sch-Lob	2–5	—	5C
Ca-Lob	2–4	—	5C	Wld-Sch	2–5	—	5C
	5	—	5C		6	—	6T
Cn	2–4	5W		Wld-Sch-Msk	5	—	5C
Hb	2–4	6^{M}_{P}	6^{M}_{P}		6	—	5C
Ht1	2–5	6M	6M	(Wld-Msk)1	2–5	—	5C
Ht-Kz	2–5	6M-O	6M-O		6	—	6T
Hub1	1–4	4D	5C	(Wld-Msk)2	2–5	—	5C
	5	4^{T}_{D}	5C		6	—	6T
	6	5^{T}_{D}	6T	(Lob-Sch)1	2–5	—	5C
Hub2	2–4	4D	5C		6	—	6T
	5	4^{T}_{D}	5C	(Lob-Sch)2	2–5	—	5C6W
Hub-Mw	2–4	4D	5C		6	—	6T
	5	4T6M	5C6M	Lob-Sch-O	2–5	—	5C-O
	6	5^{T}_{D}6M	6T	Lob-Sch-Msk	2–5	—	5C
Md	5	6^{M}_{T}	6^{M}_{T}		6	—	6T
	6	6T	6T	Stb-Ndg	4–5	—	5C
Ml1	2–4	3C	n.a.		6	—	6T
Mw1	2–4	4D	5C	Stb-Kz	4–5	—	5C-O
Mw2	2–4	4D6W	5C6W	Stb-Ndg-Msk	5	—	5C
Mw3	2–4	4D3C	5C		6	—	6T

Table 6. Productivity ranking of soils for white spruce and lodgepole pine

Productivity for white spruce		Site index	Productivity for lodgepole pine		Site index
Codner		85	Maywood	76±8	75
Raven	88±8[1]		Macola		
Macola	81±4		Hubalta	68±7	
Bremay	79±9		Bremay	67±6	
Maywood	75±8		Wildhay		
Hubalta	75±10		Lobley		
Wildhay			Stolberg		
Lobley			Sunchild		
Sunchild			Nordegg		
Stolberg			Caroline		
Nordegg			Prentice		
Caroline			Horburg	64±8	
Prentice		65	Heart	60±8	60
Horburg			Codner		
Organic			Raven		n.p.
Heart		n.p.	Organic		

[1] Site index figures taken from Lesko and Lindsay (1973).

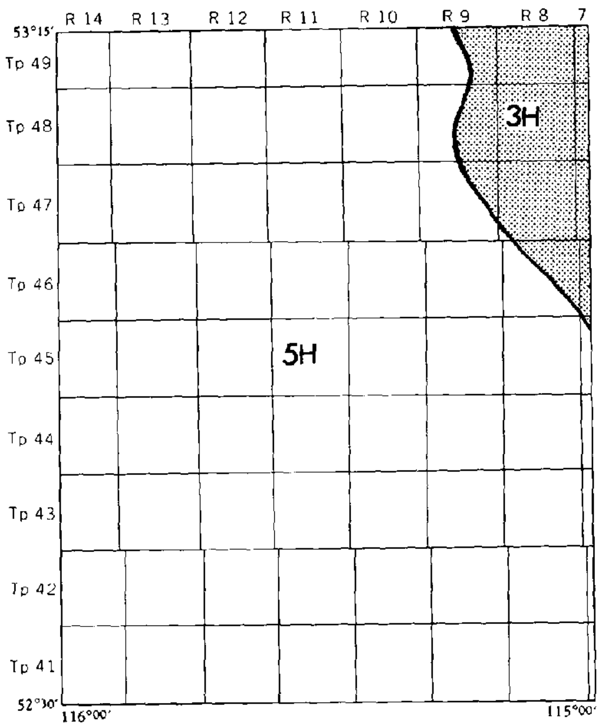


Fig. 37. Agroclimatic subregions.

Table 7. Interpretations of soil performance for forest management

Soil unit	CLI	Moisture status: For lodgepole pine	Moisture status: For white spruce	Natural regeneration	Windthrow hazard	Soil damage hazard	Slopes	Comments
Ca1	4m	mod.	poor (dry)	1p,A	low	low	2–10%	
Ca2	4m	mod.	poor (dry)	1p-Sb	low	low	2–10%	
Ca3	4m	mod.	poor (dry)	1p	low	low	2–10%	
Ca4	4m	mod.–poor (dry)	poor (dry)	1p	low	low	2–10%	
Ca-Lob	4m	mod.	poor–fair	1p	low	low	2–30%	
Cn	6w	poor (wet)	good	Sb	high	high	0–2%	Wetness due to high water table
Hb	5m	poor (dry)	poor (dry)	1p	low	low	0–5%	Gravel and gravelly sand
Ht1	5m	poor (dry)	poor (dry)	1p	low	high	5–15%	Sand dunes difficult to revegetate if disturbed
Ht-Kz	5m7w	poor (dry, wet)	poor (dry, wet)	1p;Sb	low–high	high	0–15%	
Hub1	4m	mod.	mod.	A,1p	low	low–mod.	5–30%	
Hub2	4m	mod.	mod.–good	A,1p,Bp	low	mod.	5–30%	
Hub-Mw	4m	mod.	mod.	A,1p	low	mod.–high	5–15%	
Ml1	3	good	good	A,1p,Sw	low	high	2–10%	
Mw1	3	good	good	A,1p,Sw	low	high	2–10%	
Mw2	3	good	good		low	high	2–10%	
Mw3	3	good	good	A,1p,Sw	low	high	2–10%	
Mw-Ca	3 4m	good–mod.	good–mod.	A,1p,Sw	low	high–low	2–10%	Clays, very sticky when wet, high erosion hazard on moderate slopes

Table 7. (concluded)

Soil unit	CLI	Moisture status: For lodgepole pine	Moisture status: For white spruce	Natural regeneration	Windthrow hazard	Soil damage hazard	Slopes	Comments
Pc1	5m	poor (dry)	poor (dry)	A,1p,Sw	low	mod.	2–5%	Very sandy soils, difficult to revegetate
Pc2	5M	poor (dry–wet)	poor–good (dry)	A,1p,Sb	low	mod.	2–5%	
Rv	5w	poor (wet)	good	Sw,Sb	high	high	0–2%	Wet, clay soils
To	4m	mod.	poor (dry)	A,1p	low	low	2–5%	
Sch1	4m	mod.	poor (dry)	1p	low	low	5–10%	Loamy to silty soils, well drained
Sch2	4m	mod.	poor (dry)	1p	low	low	5–10%	
Sch-Lob	4m	good	mod.	1p	low	low	5–30%	
Wld-Sch	4m	good	mod.	1p	low	low	5–30%	
Wld-Sch-Msk	4m	good–mod.	mod.	1p	low	low	5–30%	Mostly well drained till soils, some steep slopes
(Wld-Msk)1	4m	good–mod.	mod.	1p	low	low	5–30%	
(Wld-Msk)2	4m	good–mod.	mod.	1p	low	low	5–30%	Steep slopes
(Lob-Sch)1	4m	good–mod.	mod.	1p	low	low	5–30%	Mostly well drained till soils, some steep slopes
(Lob-Sch)2	4m	good–mod.	mod.	1p	low	low	5–30%	
Lob-Sch-O	4m7w	good–poor (wet)	mod.–poor (wet)	1p-Sb	low–high	low–high	0–15%	
Lob-Sch-Msk	4m	good–mod.	mod.	1p	low	low	5–30%	
Stb-Ndg	5	good–mod.	mod.	1p	low	mod.	10–60%	Steep slopes
Stb-Kz	5 7w	good–poor (wet)	mod.–poor (wet)	1p,Sb	low–high	mod.–high	0–10%	
Stb-Ndg-Msk	5	good–mod.	mod.	1p	low	mod.	10–60%	

4.3 LAND CAPABILITY FOR UNGULATES*

The major ungulates in the Brazeau Dam area are moose, elk (wapiti), mule deer, and white-tailed deer. These animals provide considerable attraction for recreation (mostly hunting) and are thus of considerable economic importance (Stelfox and Taber 1969; Stelfox 1971).

Land units can be rated as to suitability as habitats for ungulates based on soil, vegetation, and landform characteristics. Land capability for ungulates was rated from information mapped at a scale of 1:250 000 in the Canada Land Inventory program (map sheets 83B and 83G). The Brazeau Plain was rated as mainly Class 3 (slight limitations), the Wolf Lake and O'Chiese uplands as mainly Class 4 (moderate limitations), and the Outer Foothills as mainly Class 5 (moderately severe limitations). The major river valleys were rated as Class 2 winter habitat. Rating of land systems provides a more detailed and systematic approach based on land resource data. The land systems of the Brazeau Dam area have been gathered into groups of units with similar performance based on the ecology of the various ungulates, and given general ratings (Table 8).

The area supports a large resident moose population. Several studies have shown that moose distribution correlates closely with habitat composition. In spring and summer the moose make much use of aquatic vegetation in wetland areas, moving to areas with extensive willow and dwarf birch in early winter and to upland mixed-wood forests in midwinter (Pimlott 1953; Soper 1964; Kelsall and Telfer 1974; EPEC Consulting Western Ltd. 1976, personal communication).

Elk range extensively through the study area. Preferred habitat types are open grasslands and open-canopy deciduous or mixed-wood forest. Elk in Alberta are predominantly grazers although their diet is seasonally supplemented by herbaceous plants and shrubs (Stelfox and Taber 1969; Blood 1966; Flook 1970; Soper 1970).

White-tailed deer are near the western limit of their range in this area and are most abundant along the eastern edge of the map area. The fringe of the agricultural land is a particularly good habitat for white-tailed deer. These animals change location seasonally in response to snow cover and availability of grasses, forbs, and shrubs.

* Prepared with the assistance of D. Westworth.

Table 8. Suitability of common land systems for ungulate productivity

Soil and land units	Land systems	Suitability for ungulates
Brazeau Plain and Crimson Lake Plain land district		
O	Black spruce–sphagnum bog, Organic (Kenzie) soils; sedge fen, Organic (Eaglesham) soils	Prime spring and summer habitat for moose
Pc1, Pc2, Ht1	Lodgepole pine–black spruce on sands, Luvisolic (Prentice) soils; lodgepole pine–black spruce on duned sand, Brunisolic (Heart) soils	Poor for moose, elk, and deer
Mw1, Mw2, Mw3, Mw-Ca; Ml1	Trembling aspen–white spruce on lacustrine clays, Luvisolic (Maywood, Macola) soils	Good winter and summer habitat for moose, elk, and deer
Rv	Black spruce on lacustrine clays, poorly drained Gleysolic (Raven) soils	Poor for moose, elk, and deer
Ca1, Ca3, Ca4	Lodgepole pine–black spruce on silts and fine sands, Luvisolic (Caroline) soils	Poor for moose, elk, and deer
Cn, Ca2	Grasslands and willow–grass on silts and sands, Gleysolic (Codner) and Luvisolic (Caroline) soils	Prime habitat for elk, early winter browse for moose
RB, AV		River banks and valley bottoms provide important winter range for deer and browse for all ungulates
Buck Lake Upland land district		
O	Black spruce–sphagnum bog, Organic (Kenzie) soils; sedge fen, Organic (Eaglesham) soils	Prime spring and summer habitat for moose
Hub1, Hub2, Hub3, Hub-Mw	Trembling aspen–white spruce on clay loam till, Luvisolic (Hubalta) soils	Good winter and summer habitat for moose, elk, and deer
Hub1, Hub2, Hub-Mw	Lodgepole pine on clay loam till, Luvisolic (Hubalta) soils	Poor for moose, elk, and deer
O'Chiese Upland land district		
O	Black spruce–sphagnum bog, Organic (Kenzie) soils; sedge fen, Organic (Eaglesham) soils	Prime spring and summer habitat for moose
Sch1, Sch2, Sch-Lob-O	Trembling aspen–white spruce on silty veneers over till, Luvisolic (Sunchild) soils	Good winter and summer habitat for moose, elk, and deer
(Lob-Sch)1, Lob-Sch-Msk	Lodgepole pine on loamy till, Luvisolic (Lobley) soils	Poor for moose, elk, and deer
Sch2, Sch-Lob	Lodgepole pine on silty veneers over till, Luvisolic (Sunchild) soils	Poor for moose, elk, and deer
Wolf Lake Upland land district		
Wld-Sch, Wld-Sch-Msk, (Wld-Msk)1, (Wld-Msk)2	Lodgepole pine on loamy till, Luvisolic (Wildhay) soils, and on silty veneers over till (Sunchild) soils	Poor for moose, elk, and deer; animals mostly use occasional mixed-wood areas
O	Black spruce–sphagnum bog, Organic (Kenzie) soils; sedge fen, Organic (Eaglesham) soils	Prime spring and summer habitat for moose
Outer Foothills land district		
Stb-Ndg, Stb-Ndg-Msk	Lodgepole pine on loamy till, Luvisolic (Stolberg) soils	Poor for moose, elk, and deer; animals use narrow valleys with poorly drained soils and associated vegetation
Stb-Kz	White spruce–fir on loamy till, Luvisolic (Stolberg) soils	Good winter and summer habitat for moose, elk, and deer
O	Black spruce–sphagnum bog, Organic (Kenzie) soils; sedge fen, Organic (Eaglesham) soils	Prime spring and summer habitat for moose

Mule deer are present throughout the map area. Their diets are similar to those of the white-tailed deer but mule deer make more use of the coniferous forests. Deer avoid deep snow accumulations by congregating on windswept ridges or heavily forested valleys where snow cover is thinner.

4.4 LAND CAPABILITY FOR RECREATION

Use of the East Slopes area of Alberta as recreational land is increasing. Soil and related land properties often limit the suitability of the land for recreational use. Soil wetness, flooding hazard, steep slopes, and unstable soil conditions cause limitations of varying degrees for uses such as camping sites or picnic areas and associated roads and buildings or for locating trails (USDA 1972; Montgomery and Edminster 1966).

A proper perspective must be placed on the use of soil interpretations in recreational land use planning. The interpretations are evaluations of soil performance based on natural soil properties and the uses considered are facility-oriented (concentrated) types of use. Factors such as aesthetic values and nearness to population centers are not considered. The limitations of mapping scale must also be appreciated as areas of strongly contrasting soils may not be large enough to show on the map. A soil map, properly interpreted, is a useful guide for general recreational planning and for site selection. *However, on-site investigations are still required before design and construction of facilities.*

The soils are grouped into three categories according to their limitations or suitabilities for specific uses (Table 9). They are evaluated by considering the interaction of the various properties to give an overall degree of limitation or suitability to each map unit. The three categories of limitations are as follows:

S—None to slight soil limitations Soils relatively free from limitations that affect the intended use, or having limitations that are easy to overcome.

M—Moderate soil limitations Soils having limitations that need to be recognized but can be overcome with correct planning, careful design, and good management.

X—Severe soil limitations Soils with limitations severe enough to make the proposed use questionable. This designation does not mean the soil cannot be used for a specific purpose but it does mean that careful planning and design, and very good management, are needed. This often includes major soil reclamation work. In many cases it is not economically feasible to correct the limitations.

4.5 ENGINEERING USES OF SOILS

Soils are used for construction materials and sites, and certain soil properties are of special interest to engineers and others concerned with planning construction and maintenance of engineering works. This section of the report describes properties (Table 10) and limitations of the soil units that are of special significance to uses such as the location and construction of roads and buildings.

The estimates of soil performance must be considered *as estimates* of general properties of soil material groups, not as test data from specific sites. These estimates provide guidelines for area planning and a basis for detailed soil investigations. Because of the limitations of scale of the soil map (1:126 720), small areas of contrasting soils do not show. On-site inspections are always required before development proceeds. Interpretations of soil properties are based on observations made in the field and related to published guidelines (USDA 1972). These observations are usually limited to a depth of 1 m, but estimates of deeper materials can be made by applying knowledge of surficial geology and geomorphology.

The information contained on the soil map and legend should be used in conjunction with the written descriptions of soil units to obtain as much information as possible about land units. The available information includes soil material characteristics, steepness of slopes, soil moisture conditions, water table depths, and depth to bedrock. Based on a knowledge of soil and land characteristics, it is possible to make good, though general, evaluations of limitations or suitability of soil units for such uses as location of roads or pipelines, or as sources of sand or gravel. Evaluation of environmental sensitivity and estimates of construction and maintenance costs are aided by an understanding of terrain conditions.

The terminology used in pedology and soil engineering is not always consistent, and may be confusing. The terms used in this report are used in the pedological sense and many are defined in the Glossary.

Table 9. Limitations of soil units for recreational uses

Soil unit	Camp and picnic areas	Trails	Damage hazard	Soil features influencing use
Ca1	S	M	low	Silty and fine sandy surface horizons, rapid infiltrations
Ca2	S	M	low	
Ca3	S	M	low	
Ca4	S	M	low	
Cn	X	X	high	High water table, silty textured
Ht1	X	X	high	Dune sand—low stability, droughty, low fertility
Ht-Kz	X	X	high	
Hb	M	S	low	Gravelly sand, droughty, low fertility
Hub1	S	S	low	Some slopes limiting
Hub2	S	S	low	
Hub3	S	S	low	
Hub-Mw	S-X	S-X	low–high	
Ml1	X	X	high	High clay content, soils sticky when wet and dry slowly after wetting, high erosion and slumping hazard
Mw1	X	X	high	
Mw2	X	X	high	
Mw3	X	X	high	
Mw-Ca	X	X	high	
Pc1	X	X	high	Sands—low stability, droughty
Pc2	X	X	high	
Rv	X	X	high	High water table, high clay content
To	S-M	S-M	mod.	Silts and sands, moderate stability
Wld-Sch	S-M	S	mod.–low	Some topography limitations
Wld-Sch-Msk	M-X	S	low	Topography limitations; some wet areas in (Wld-Msk)2
(Wld-Msk)1	M-X	S	low	
(Wld-Msk)2	M-X	S	mod.–high	
Sch1	S	S	low	Loamy, permeable materials
Sch2	S	S	low	
Sch-Lob	S	S	low	
Sch-Lob-O	S-X	S-X	low–high	Organic soils limiting
(Lob-Sch)1	S-M	S	low	Loamy, permeable materials but slope often limiting
(Lob-Sch)2	S-M	S	low	
Lob-Sch-O	S-X	S-X	low–high	Organic soils severely limiting
Lob-Sch-Msk	M-X	M	low	Loamy, permeable materials but slopes often limiting
Stb-Ndg	M-X	M	low	Permeable, loamy materials but slope usually limiting
Stb-Ndg-Msk	M-X	S-M	low	Permeable, loamy materials but slope usually limiting
AV	S-X	S-X	low–high	Position on terraces or floodplain determines suitability
O	X	X	high	Organic soils severely limiting to uses
RB	X	X	high	Very steep slopes, unstable soils

Table 10. Estimated soil properties significant to engineering uses[1]

Soil unit	Soil name	Depth (m) To bedrock	Depth (m) To seasonal water table	Depth from surface (cm)	USDA texture	Classification Unified	Classification AASHO	Liquid limit	Plasticity index	Permeability	Salinity	Shrink-swell potential	Comments
Ca1, Ca2, Ca3, Ca4, Ca-Lob	Caroline	>3[2]	>2	0–50	loam to silt loam	ML	A-4	var.	var.	rapid	nil	low	
				50+	silty clay loam to clay loam	CL	A-6	25–35	10–15	slow	nil	mod.	Till may occur at less than 1 m
Cn	Codner	>3	0	0–50	loam to silt loam	ML	A-4	var.	var.	rapid	nil	low	
				50+	silty clay loam to clay loam	CL	A-6	25–35	10–15	slow	nil	mod.	
Hb	Horburg	>3	>2	0–20	loamy sand	SM	A-2-4	n.p.	n.p.	rapid	nil	nil	Suitable for gravel aggregate; sorting and stone size variable
				20+	very gravelly	GP	A-1	n.p.	n.p.	rapid	nil	nil	
Ht1 Ht-Kz	Heart	>3	>2 0–>2	0–100	loamy sand to sand	SM	A-2-4	n.p.	n.p.	rapid	nil	nil	Sand dunes, often with bogs between dunes
Hub1, Hub2, Hub3, Hub-Mw	Hubalta	1–>3	0.5–>2	20–100	clay loam	CL	A-6 or A-7	30–40	15–20	mod.	nil	mod.	Some high water table areas and seepage in Hub1; some fine clayey materials; till overlies sandstone on ridges; slightly stony
Ml1	Macola	>3	1–2	20–100	clay	CH	A-7	65–75	40–50	slow	nil–low	high	Clays and silty clays; stone-free; slow surface and internal drainage; slumping hazard
Mw1, Mw2, Mw3, Mw-Ca	Maywood	>3	1–2	20–100	clay	CH	A-7	65–75	40–50	slow	nil–low		
Pc1, Pc2	Prentice	>3	>2	0–100	loamy sand	SM-SP	A-3	n.p.	n.p.	high	nil	nil	Stone-free sands, poorly to well sorted
Rv	Raven	>3	0	20–100	clay	CH	A-7	65–75	45–55	slow	low	high	Stone-free clays and silty clays
To	Tolman	>3	>2	0–50	sandy loam	SM	A-2-4	n.p.	n.p.	rapid	nil	nil	Layered sandy and silty materials; stone-free
				50–100	silt loam to clay loam	ML-CL	A-4	25–35	10–15	mod.		low–mod.	
Wld-Sch	Wildhay	1–>3	>2	2–100	loam and silt loam	ML-CL	A-4	25–35	10–15	mod.	nil	low	Moderately stony till
Wld-Sch-Msk		0–>3	>2	0–30	loam and silt loam	ML	A-4	var.	var.	rapid	nil	low	Loam to silt loam over loamy till
				30–100	loam	ML-CL	A-4	25–35	10–15				
(Wld-Msk)1 (Wld-Msk)2		0>2 0–>2	>2 0–>2		loam and loamy sand	ML-CL and SM		var.	var.	rapid–mod.	nil	low	Bedrock has soft and hard layers, sandstone and siltstone

Sch1		>3	>2	0–30	loam and	ML	A-4	var.	var.	rapid	nil	low	1-3 m loam to silt loam over loamy till; 0.2–0.5 m loam to silt loam over loamy till
Sch2	Sunchild	>3	0–>2		silt loam								
Sch-Lob		>3	>2	30–100	loam	ML-CL	A-4						
Sch-Lob-O		>3	0–>2		(Similar to Sch with Wld)								
(Lob-Sch)1	Lobley	>3	>2	30–100	sandy loam to loam	ML	A-4	25–30	10–15	mod.–rapid	nil	low	Moderately stony till
(Lob-Sch)2		>3	0–>2										
Lob-Sch-O		>3	0–>2										
Lob-Sch-Msk		0–>3	>2										
Stb-Ndg	Stolberg	3–1	>2	20–100	loam and silt loam	ML	A-4	25–30	10–15	mod.–rapid	nil	low	
Stb-Ndg-Msk		3–0	>2	30–100	loam and silt loam	ML	A-4	25–30	10–15				0.2–5 m loam to silt loam over loamy till over bedrock
Stb-Kz		>3	0–>2	0–30	loam and organic	ML	A-4	—	—	mod.–rapid	nil	low	
O	Organic	>3	0	0–100	peat	—	—	n.p.	n.p.	rapid–slow	nil	—	Bog (muskeg) peat and fen (sedge) peat

[1] Absence of data indicates the soil is too variable to be rated or that no estimate was made.
[2] > means greater than.

REFERENCES

Blood, D. A. 1966. Range relationships of elk and cattle in Riding Mountain National Park, Manitoba. Can. Wildl. Serv., Wildl. Manage. Bull., Ser. 1, No. 19. 62 pp.

Bostock, H. S. 1970. Physiographic subdivisions of Canada. Pages 9-31 *in* R. J. W. Douglas, ed. Geology and economic minerals of Canada. Geol. Surv. Can., Dep. Energy, Mines and Resour., Ottawa.

Bowser, W. E. 1967. Agro-climatic areas of Alberta. Surveys and Mapping Branch, Dep. Energy, Mines and Resour., Ottawa.

Boydell, A., Bayrock, L., and Reimchen, T. 1974. Surficial geology 1:250,000 Rocky Mountain House.

Brocke, L. K. 1977. The Canada Land Inventory soil capability for agriculture in Alberta. Alta. Environ., Edmonton.

Canada Land Inventory. 1972. Soil capability classification for agriculture. Rep. No. 2. Environ. Can., Ottawa.

Canada Soil Survey Committee, Subcommittee on Soil Classification. 1978. The Canadian system of soil classification., Agric. Can. Publ. 1646. Supply and Services Canada, Ottawa. 164 pp.

Christian, C. S., and Stewart, G. A. 1968. Methodology on integrated survey. Pages 233-280 *in* Aerial surveys and integrated studies. Proc. Toulouse Conf. (1964), Unesco, Paris.

Duffy, P. J. B. 1962. The use of soil survey reports in the appraisal of forest and productivity in Alberta. For Chron. 38(2):208-211.

Duffy, P. J. B. 1964. Relationships between site factors and growth of lodgepole pine in the Foothills section of Alberta. Can. Dep. For. Publ. 1065. 58 pp.

Dumanski, J., Macyk, T. M., Veauvy, C. F., and Lindsay, J. D. 1972. Soil survey and land evaluation of the Hinton–Edson area, Alberta. Alta. Inst. Pedol. Rep. S72-31. Univ. of Alta., Edmonton.

Flook, D. R. 1970. Causes and implications of an observed sex differential in the survival of wapiti. Can. Wildl. Serv., Rep. Ser. No. 11. Environ. Can., Ottawa. 71 pp.

Gish, E. S. 1952. History of the Rocky Mountain House area. M.S. Thesis. Univ. of Alberta, Edmonton.

Green, R. 1972. Geological map of Alberta. Research Council of Alberta, Map No. 35. Res. Counc. Alta., Edmonton.

Horton, K. W. 1956. Ecology of lodgepole pine in Alberta and its role in forest succession. For. Res. Div. Tech. Note No. 45. Environ. Can., Ottawa. 29 pp.

Horton, K. W., and Lees, J. C. 1961. Black spruce in the Foothills of Alberta. For. Res. Branch Tech. Note No. 110. Environ. Can., Ottawa. 54 pp.

Jurdant, M., Lacate, D. S., Zoltai, S. C., Runda, G. G., and Wells, R. 1975. Bio-physical land classification in Canada. Pages 485-495 *in* Bernier, B., and Winget, C. H., eds. Forest soils and forest land management. Proc. 4th N. Am. For. Soils Conf. Les Presses de L'Université Laval, Québec.

Kelsall, J. P., and Telfer, E. S. 1974. Biogeography of moose with particular reference to western North America. Nat. Can. (Québec) 101:117-130.

Lacate, D. S. 1969. Guidelines for bio-physical land classification. Can. For. Serv. Publ. 1204. Environ. Can., Ottawa. 61 pp.

Lesko, G. L., and Lindsay, J. D. 1973 Forest/soil relationships and management considerations in a portion of the Chip Lake map area, Alberta. Alta. Res. Counc. Rep. 73-1. Edmonton.

Lindsay, J. D., Odinsky, W., Peters, T. W., and Bowser, E. W. 1968. Soil survey of the Buck Lake and Wabamun Lake areas. Alta. Soil Survey Rep. No. 24. Univ. of Alta., Edmonton.

Longley, R. W. 1967. The frost-free period in Alberta. Can. J. Plant Sci. 47:239-249.

Longley, R. W., and Louis-Byne, M. 1967. Forest hollows in west central Alberta. DOT Meteorol. Branch. Tech. Cir. Ser. Cir. 4532, Tech. 639. 15 pp.

MacGregor, J. G. 1949. Blankets and beads: A history of the North Saskatchewan River. Inst. of Applied Art, Edmonton.

MacGregor, J. C. 1972. A history of Alberta. Hurtig, Edmonton. 335 pp.

Montgomery, P. H., and Edminster, F. C. 1966. The use of soil surveys in planning for recreation. Pages 104-112 *in* Bartelli, L. J. et al., eds. Soil surveys and land use planning. Soil Sci. Soc. Am. and Am. Soc. Agron., Madison, Wisconsin.

Moss, E. H. 1932. Poplar association. J. Ecol. 20 (2):30-415.

Moss, E. H. 1955. Vegetation of Alberta. Bot. Rev. 21(9):493-567.

Peters, T. W. 1968. Soil capability for agriculture. Rocky Mountain House—83B. Canada Land Inventory, Queen's Printer, Ottawa.

Peters, T. W., and Bowser, W. E. 1960. Soil survey of Rocky Mountain House sheet. Alta. Soil Surv. Rep. 19. Univ. of Alberta, Edmonton.

Pimlott, D. H. 1953. Newfoundland moose. Trans. N. Am. Wildl. Conf. 18:563-581.

Portland Cement Association. 1962. PCA soil primer. Chicago, Illinois.

Rowe, J. S. 1972. Forest regions of Canada. Can. For. Serv. Publ. 1300. Environ. Can., Ottawa. 172 pp.

Smithers, L. A. 1962. Lodgepole pine in Alberta. Can. Dep. For. Bull. 127. Environ. Can., Ottawa. 153 pp.

Soper, J. D. 1964. The mammals of Alberta. Alta. Dep. of Industry and Development, Edmonton. 402 pp.

Soper, J. D. 1970. The mammals of Jasper National Park, Alberta. Can. Wildl. Serv. Rep. Ser. No. 10. Environ. Can., Ottawa. 80 pp.

Spry, I. M. 1968. The Palliser expedition. An account of John Palliser's British North American Exploring Expedition 1857–1860. MacMillan, Toronto. 310 pp.

Stelfox, J. G. 1971. Biotic-abiotic factors influencing forage palatability preference and range carrying capacity. Can. Wildl. Serv. unpubl. report. Environ. Can., Ottawa. 37 pp.

Stelfox, J. G., and Taber, R. D. 1969. Big game in the northern Rocky Mountain coniferous forest. Pages 197-222 *in* Proc. Symp. on Coniferous Forests of the Northern Rocky Mountains, 1968, Missoula, Montana.

Thie, J., and Ironside, G., eds. 1977. Proceedings of 1st Meeting, Can. Comm. Ecological (Biophysical) Land Class., May 1976, Petawawa, Ontario. Lands Directorate, Environ. Can., Ottawa. 269 pp.

Tokarsky, O. 1971. Hydrogeology of the Rocky Mountain House area, Alberta. Res. Counc. Alta. Rep. 71-3. 15 pp.

Twardy, A. G., and Lindsay, J. D. 1971. Soil survey of the Chip Lake area. Alta. Soil Survey, Rep. No. 28, Univ. of Alta., Edmonton.

Twardy, A. G., Lindsay, J. D., and Peters, T. W. n.d. Soil capability for agriculture—Wabamun 83G. Canada Land Inventory, Queen's Printer, Ottawa.

United States Department of Agriculture (USDA). 1972. Guide for interpreting engineering uses of soils. Soil Conserv. Serv., Washington, D.C..

GLOSSARY OF TERMS

This glossary is included to define terms commonly used in the report; it is not a comprehensive soil glossary.

acid soil a soil having a pH of less than 7.0.

aggregate a group of soil particles cohering so as to behave mechanically as a unit.

alkaline soil a soil having a pH greater than 7.0.

aspect orientation of the land surface with respect to compass direction.

Atterberg limits various moisture contents of a soil at which it changes from one major physical condition to another. The Atterberg limits that are most useful for engineering purposes are liquid limit and plastic limit. The liquid limit is the moisture content at which a soil passes from a plastic to a liquid state. The plastic limit is the moisture content at which a soil changes from a semisolid to a plastic state.
Plasticity index (PI) is defined as the numerical difference between liquid limit and plastic limit.

available plant nutrients the portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

bearing capacity the average load per unit area that is required to rupture a supporting soil mass.

bulk density, soil the mass of dry soil per unit bulk volume.

cation an ion carrying a positive charge of electricity. The common soil cations are calcium, magnesium, sodium, potassium, and hydrogen.

cation exchange capacity (CEC) a measure of the total amount of exchangeable cations that can be held by the soil. It is expressed in terms of milliequivalents per 100 grams of soil.

coarse fragments rock or mineral particles greater than 2 mm in diameter.

consistence (*a*) the resistance of a material to deformation or rupture; (*b*) the degree of cohesion or adhesion of the soil mass.

control section the vertical section upon which soil classification is based.

creep slow mass movement of soil material down rather steep slopes primarily under the influence of gravity, but aided by saturation with water and alternate freezing and thawing.

droughty soils sandy or rapidly drained soil.

eluviation the removal of soil material in suspension or in solution from a layer or layers of the soil.

engineering tests laboratory tests made to determine the physical properties of soils that affect their uses for various types of engineering construction.

erosion the wearing away of the land surface by running water, wind, or other erosive agents. It includes both normal and accelerated soil erosion. The latter is brought about by changes in natural cover or ground conditions and includes those due to human activity.

fertility the status of a soil in relation to the amount and availability to plants of elements necessary for plant growth.

floodplain the land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

fluvial deposit sediments deposited by moving water.

frost-free period season of the year between the last frost of spring and first frost of fall.

frost heave, in soil the raising of the soil surface caused by ice formation in the underlying soil.

glaciofluvial deposit material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice.

glaciolacustrine deposit material deposited in lakes of glacial meltwater and later exposed either by a lowering of the water level or by uplift of the land.

gley gleying is a reduction process that takes place in soils that are saturated with water for long periods of time. The horizon of most intense reduction is characterized by a gray, commonly mottled appearance, which on drying shows numerous rusty brown iron stains or streaks. Those horizons in which gleying is intense are designated with the suffix g.

Gleysolic soil soil developed under wet conditions resulting in reduction of iron and other elements and in gray colors and mottles.

ground moraine unsorted mixture of rocks, boulders, sand, silt, and clay deposited by glacial ice. Predominantly till with some stratified drift. Ground moraine is usually in the form of undulating plains having gently sloping swells, sags, and enclosed depressions.

groundwater that portion of the total precipitation which at any particular time is either passing through or standing in the soil and the underlying strata and is free to move under the influence of gravity.

horizon a layer in the soil profile approximately parallel to the land surface with more or less well defined characteristics that have been produced through the operation of soil-forming processes. Soil horizons may be organic or mineral.

humus the more or less stable fraction of the soil organic matter remaining after most added plant and animal residues have decomposed. Usually it is dark colored.

hummocky moraine a till landscape composed of knobs and depressions with local relief generally in excess of 13 m. It may also include stratified drift.

illuviation the process of deposition of soil material removed from one horizon to another in the soil, usually from an upper to a lower horizon in the soil profile. Illuviated compounds include silicate clay, iron and aluminum hydrous oxides, and organic matter.

infiltration the downward entry of water into the soil.

Lithic a soil subgroup modifier that indicates a bedrock contact within 50 cm of the soil surface.

morphology, soil the makeup of the soil, including the texture, structure, consistence, color, and other physical, mineralogical, and biological properties of the various horizons of the soil profile.

mottles spots or blotches of different colors or shades of color interspersed with the dominant color. Mottling in soils usually indicates poor aeration and drainage.

organic matter (OM) the decomposition residues of plant materials, derived from (*i*) plant materials deposited on the surface of the soil, and (*ii*) roots that decay beneath the surface of the soil.

parent material unconsolidated mineral material or peat from which the soil profile develops.

peat unconsolidated soil material consisting largely of undecomposed to partly decomposed organic matter accumulated under conditions of excessive moisture.

ped a unit of soil structure such as a prism, block, or granule, formed by natural processes (in contrast to a clod, which is formed artificially).

pedology those aspects of soil science involving the constitution, distribution, genesis, and classification of soils.

percolation, soil water the downward movement of water through soil, especially the downward flow of water in saturated or nearly saturated soil at hydraulic gradients in the order of 1.0 or less.

permeability the relative ease with which gases, liquids, or plant roots penetrate or pass through a bulk mass of soil or a layer of soil. Since different horizons of soil vary in permeability, the particular horizon in question should be designated.

pH *see* reaction, soil.

phase, soil a subdivision of a taxonomic class based on soil characteristics or combinations thereof which are considered to be potentially significant to man's use or management of the land.

profile a vertical section of the soil throughout all its horizons and extending into the parent material.

reaction, soil the degree of acidity or alkalinity of a soil, usually expressed as a pH value. Descriptive terms commonly associated with certain ranges in pH are: extremely acid, <4.5; very strongly acid, 4.5–5.0; strongly acid, 5.1–5.5; moderately acid, 5.6–6.0; slightly acid, 6.1–6.5; neutral, 6.6–7.3; slightly alkaline, 7.4–7.8; moderately alkaline, 7.9–8.4; strongly alkaline, 8.5–9.0; and very strongly alkaline, >9.0.

relief the elevations or inequalities of the land surface when considered collectively. Minor configurations are referred to as "microrelief."

seepage, groundwater the emergence of water from the soil over an extensive area, in contrast to a spring where it emerges from a local spot.

shrink-swell potential the tendency of soils to undergo changes of volume with changes in water content.

solum (plural, sola) the part of the soil profile that is above the parent material and in which the processes of soil formation are active. It comprises the A and B horizons.

stratified composed of or arranged in strata or layers, as applied to parent material.

structure, soil the combination or arrangement of primary soil particles into secondary particles, units, or peds. The secondary units are characterized and classified on the basis of size, shape, and degree of distinctness into classes, types, and grades.

subsoil technically, the B horizon; broadly, the part of the profile below plow depth.

texture, soil the relative proportions of the various-sized soil separates in a soil as described by the textural class names (Fig. 38).

till unstratified glacial drift deposited directly by ice and consisting of unsorted clay, silt, sand, and boulders.

water-holding capacity the ability of soil to hold water. The water-holding capacity of sandy soils is usually considered to be low whereas that of clayey soils is high. Often expressed in millimetres of water per centimetre of soil depth.

water table the upper limit of the part of the soil or underlying rock material that is wholly saturated with water.

weathering the physical and chemical disintegration, alteration, and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

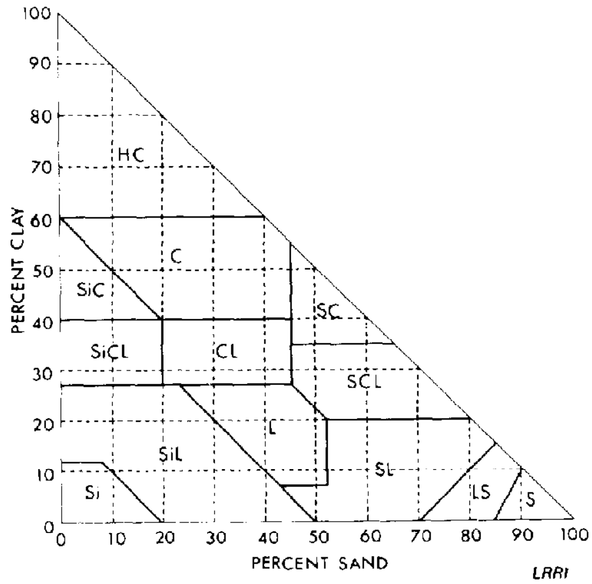


Fig. 38. Soil texture classes, showing the percentage of clay and sand in the main soil texture classes; the remainder of each class is silt.

APPENDIX

Chemical and physical analyses of selected representative soils

Analyses of a Caroline soil

Location: SW20-46-11-W5	Parent material: glaciolacustrine	Elevation: 975 m
Classification: Brunisolic Gray Luvisol	Drainage: well drained	Slope and aspect: 2-3%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-H	5-0					
Ae1	0-5	7.5YR 7/2 (D)	SiL	weak fine platy	very friable	
Bm	5-10	10YR 6/2 (D)	SiL	weak fine subangular blocky	very friable	
Ae2	10-25	10YR 8/2 (D)	SiL	weak fine platy	very friable	
Bt1	25-45	10YR 5/4 (M)	CL	weak medium subangular blocky	firm	
Bt2	45-100	10YR 5/6 (M)	CL	weak medium subangular blocky	firm	
Ck	100+	2.5Y 4/4 (M)	SL	massive	firm	calcareous

	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %		
Horizon				Ca	Mg	Na	K			sand	silt	clay
L-H	4.7	—	0.79	24.1	2.5	—	2.3	62.8	46	—	—	—
Ae1	4.7	—	0.08	4.0	0.8	0.2	0.6	12.2	46	32	57	11
Bm	5.1	—	0.07	3.8	0.5	0.2	0.6	15.4	33	33	58	9
Ae2	5.6	—	—	5.2	1.2	0.2	0.2	8.3	82	39	54	7
Bt1	5.5	—	—	16.0	4.2	0.3	0.5	19.6	100	32	40	28
Bt2	5.3	—	—	17.7	4.5	0.2	0.4	21.6	100	43	29	28
Ck	7.4	—	—	—	—	—	—	—	—	62	22	16

Analyses of a Codner soil

Location: NE33-55-12-W5	Parent material: fluvial over lacustrine	Elevation: 875 m
Classification: Orthic Humic Gleysol	Drainage: poorly drained	Slope and aspect: 0–1%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L–H	15–0					
Ahg	0–15	10YR 3/2	L	strong fine granular	very friable	
Bg	15–37	10YR 5/4	SL	single grain	very friable	
BCg	37–70	10YR 4/3	L	stratified	friable	
Ckg	70+	10YR 4/3	SiCL	stratified	friable	weakly calcareous

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %		
				Ca	Mg	Na	K			sand	silt	clay
L-H	6.4	—	—	26.2	4.4	0.19	0.46	36.8	85	—	—	—
Ahg	6.8	4.8	0.31	12.9	2.7	0.46	0.14	15.0	100	42	47	11
Bg	7.0	0.9	0.04	10.8	3.5	0.09	0.21	12.4	100	69	19	12
BCg	6.9	—	—	12.5	4.2	0.12	0.31	16.2	100	34	46	20
Ckg	7.0	—	—	17.2	4.7	0.07	0.39	20.9	100	6	62	32

Analyses of a Heart soil

Location: SW6-48-13-W5	Parent material: sand	Elevation: 1000 m
Classification: Eluviated Dystric Brunisol	Drainage: rapidly drained	Slope and aspect: 3%, NE

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L–H	5–0					
Ae	0–5	10YR 6/2 (M)	LS	single grain	loose	vegetation: lodgepole pine-black spruce
Bf	5–12	10YR 5/6 (M)	SL	single grain	loose	
Bm	12–50	10YR 5/4 (M)	LS	single grain	loose	
C	50+	10YR 6/4 (M)	LS	single grain	loose	

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %			Fe + Al oxal. extr.
				Ca	Mg	Na	K			sand	silt	clay	
Ae	4.7	2.7	0.06	0.39	0.34	0.05	0.22	13.0	8	—	—	—	0.46
Bf	6.2	2.0	0.06	0.78	0.35	0.03	0.53	12.6	13	—	—	—	1.57
Bm	5.4	0.3	0.01	4.06	1.13	0.06	0.26	9.7	57	—	—	—	0.38
C	6.0	—	—	4.25	1.08	0.03	0.20	8.8	63	—	—	—	0.27

Analyses of a Horburg soil

Location: 3-48-13-W5, S of Dismal Creek	Parent material: glaciofluvial gravels	Elevation: 975 m
Classification: Eluviated Eutric Brunisol	Drainage: rapidly drained	Slope and aspect: 1–2%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-H	5–0					
Ae	0–5	7.5YR 6/2 (M)	CSiL	weak fine platy	very friable	vegetation: lodgepole pine–*Vaccinium*–feather mosses
Bm	5–20	10YR 5/6 (M)	CSiL	weak fine platy	very friable	
C	20–25	10YR 6/3 (M)	CSL	single grain	loose	
IIC	25+	—	VGS	single grain	loose	

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g Ca	Mg	Na	K	CEC meq/ 100 g	Base sat. %	Particle size distribution, % sand	silt	clay
L-H	4.4	—	1.14	19.1	4.2	0.6	2.9	66.5	40	—	—	—
Ae	4.9	—	0.09	4.0	0.5	0.2	0.4	10.5	48	35	60	5
Bm	5.5	—	0.15	4.0	0.2	0.2	0.3	14.6	32	37	58	5
C	5.8	—	—	4.5	0.8	—	0.2	6.3	87	59	40	1

Analyses of a Hubalta soil

Location: SE31-53-10-W5	Parent material: clay loam till	Elevation: 800 m
Classification: Orthic Gray Luvisol	Drainage: moderately well drained	Slope and aspect:

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-H	2–0					
Ae	0–10	10YR 5/4 (M)	SiL	strong medium platy	very friable	
AB	10–18	10YR 5/3 (M)	CL	moderate fine subangular blocky	firm	
Bt	18–80	10YR 4/3 (M)	CL	strong medium subangular blocky	firm	
BC	80–125	2.5Y 4/4 (M)	CL	weak medium blocky	firm	
Ck	125+	2.5Y 4/4 (M)	CL	amorphous	firm	calcareous

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g Ca	Mg	Na	K	CEC meq/ 100 g	Base sat. %	Particle size distribution, % sand	silt	clay
Ae	6.9	0.25	0.04	4.4	3.1	0.1	0.4	5.6	100	25	64	11
AB	6.5	1.2	0.05	14.3	4.8	tr	0.6	17.1	100	28	43	29
Bt	5.1	0.86	0.03	17.4	6.8	0.2	0.4	24.1	100	32	31	37
BC	5.0	—	—	17.9	6.4	0.2	0.3	23.2	100	33	31	36
Ck	7.1	—	—	31.0	6.9	0.1	0.4	20.9	100	35	32	33

Analyses of a Lobley soil

Location: 9-40-9-W5	Parent material: till	Elevation: 1050 m
Classification: Brunisolic Gray Luvisol	Drainage: well drained	Slope and aspect: 1-2%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-H	5-0					
Ae1	0-3	10YR 7/2	SL	strong fine platy	very friable	
Bm	3-8	10YR 6/4	L	moderate fine platy	very friable	
Ae2	8-18	10YR 7/2	SL	strong fine platy	very friable	
Bt	18-40	10YR 5/4	SCL	strong fine subangular blocky	firm	
BC	40-72	2.5Y 4/4	SCL	massive	firm	
Ck	72+	2.5Y 4/4	SCL	massive	firm	calcareous

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %		
				Ca	Mg	Na	K			sand	silt	clay
L-H	4.8	30.6	—	—	—	—	—	—	—	—	—	—
Ae1	5.0	1.6	—	0.27	0.24	—	—	—	—	59	34	7
Bm	5.8	1.2	—	0.33	0.21	—	—	—	—	50	38	12
Ae2	6.0	0.4	—	0.23	0.16	—	—	—	—	59	32	9
Bt	5.1	0.4	—	0.41	0.15	—	—	—	—	48	21	31
BC	6.7	—	—	0.37	0.31	—	—	—	—	53	24	23
Ck	8.0	—	—	3.9	0.56	—	—	—	—	48	21	31

Analyses of a Macola soil

Location: SE5-49-7-W5	Parent material: glaciolacustrine clays	Elevation: 825 m
Classification: Dark Gray Luvisol	Drainage: moderately well drained	Slope and aspect: 1–2%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
Ah	0–10	10YR 2/1	SiCL	granular	friable	
Ae	10–15	2.5Y 5/2	SiCL	platy	friable	
AB	15–35	10YR 5/2	SiCL	subangular blocky	firm	
Bt	35–60	10YR 3/2	C	subangular blocky	firm	
Ck1	60–75	10YR 3/2	C	massive	firm	calcareous
Ck2	75+	10YR 4/4	C	massive	firm	calcareous

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %			$CaCO_3$ %
				Ca	Mg	Na	K			sand	silt	clay	
Ah	5.8	14	0.63	28.4	13.8	0.4	2.3	53.6	84	17	40	43	—
Ae	5.1	2.4	0.11	11.9	4.2	0.5	0.6	22.7	76	18	41	41	—
AB	4.7	1.3	0.07	14.4	6.5	0.4	0.5	26.2	82	12	58	30	—
Bt	5.0	1.1	0.04	27.5	12.8	0.8	0.6	44.3	94	4	25	71	—
Ck1	7.1	—	—	—	—	—	—	—	—	3	20	77	4.6
Ck2	7.2	—	—	—	—	—	—	—	—	1	19	80	10.8

Analyses of a Maskuta soil (from map 83F)

Location: SW21-55-18-W5	Parent material: weathered sandstone	Elevation: 1150 m
Classification: Orthic Gray Luvisol	Drainage: well drained	Slope and aspect: 5%, S

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-H	5-0					
Ae1	0-8	10YR 6/2	L	moderate medium platy	friable	
Ae2	8-22	10YR 6/3	SL	weak medium platy	friable	
Bt1	22-58	10YR 5/6	SL	weak fine subangular blocky	friable	
Bt2	58-85	2.5Y 5/4	SL	weak fine subangular blocky	friable	
BC	85-120	2.5Y 4/4	SL	amorphous	firm	
Ck	120+	2.5Y 4/4	SL	amorphous	firm	

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %			$CaCO_3$ %
				Ca	Mg	Na	K			sand	silt	clay	
L-H	5.9	—	1.16	42.1	4.3	0.0	2.4	63.8	74	—	—	—	—
Ae1	5.9	—	0.06	6.9	1.3	0.1	0.3	11.1	78	50	39	11	—
Ae2	6.4	—	0.03	6.4	0.8	0.0	0.3	8.4	89	67	24	9	—
Bt1	6.2	—	0.02	9.4	2.4	0.0	0.3	13.1	93	68	17	15	—
Bt2	6.1	—	0.02	8.9	2.4	0.0	0.3	12.6	92	63	22	15	—
BC	6.4	—	—	9.4	1.6	0.0	0.3	12.1	94	62	23	15	—
Ck	7.7	—	—	—	—	—	—	—	—	65	22	13	9.3

Analyses of a Maywood soil

Location: SE27-48-9-W5, W of Pembina R.	Parent material: glaciolacustrine clays	Elevation: 870 m
Classification: Orthic Gray Luvisol	Drainage: moderately well drained	Slope and aspect: 1-2%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-H	7-0					
Ahe	0-4	10YR 4/2 (M)	SiL	fine platy	friable	
Ae	4-11	10YR 7/3 (M)	SiL	fine platy	friable	
AB	11-17	10YR 6/3 (M)	SiL	fine subangular blocky	firm	
Bt	17-45	10YR 5/2 (M)	SiC	fine subangular blocky	hard	
BC	45-60	10YR 5/4 (M)	SiC			

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %		
				Ca	Mg	Na	K			sand	silt	clay
Ahe	5.4	2.1	0.09	3.75	0.41	0.11	0.39	15.2	30	13	71	16
Ae	5.5	0.6	0.03	3.44	0.20	0.08	0.09	6.6	58	17	76	7
AB	5.3	0.8	0.04	5.47	0.67	0.08	0.23	10.8	60	11	73	16
Bt	5.2	0.8	0.04	18.6	3.84	0.18	0.47	25.7	90	1	59	40
BC	5.4	—	—	20.6	4.81	0.16	0.41	29.7	87	1	59	40

Analyses of a Prentice soil

Location: E8-47-12-W5	Parent material: sand	Elevation: 990 m
Classification: Brunisolic Gray Luvisol	Drainage: well–rapidly drained	Slope and aspect: 3%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L–H	8–0					
Ae1	0–3	7.5YR 5/2 (M)	SL	weak coarse platy	very friable	vegetation: lodgepole pine–black spruce
Bf	3–8	7.5YR 5/4 (M)	SL	weak coarse platy	very friable	
Ae2	8–20	10YR 5/4 (M)	SL	weak coarse platy	very friable	
Bt	20–32	10YR 4/4 (M)	SL–L	weak medium subangular blocky	friable	
BC	32–75	10YR 4/3 (M)	SL–LS	single grain	loose	
Ck	75+	10YR 4/4 (M)	SL–LS	single grain	loose	

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %			Fe + Al oxal. extr.
				Ca	Mg	Na	K			sand	silt	clay	
Ae1	4.5	—	—	—	—	—	—	—	—	—	—	—	
Bf	5.0	—	—	—	—	—	—	14.0	—	—	—	—	0.82
Ae2	5.5	—	—	—	—	—	—	11.7	—	—	—	—	0.49
Bt	6.0	—	—	—	—	—	—	—	—	—	—	—	—
BC	6.5	—	—	—	—	—	—	—	—	—	—	—	—
C	7.0	—	—	—	—	—	—	—	—	—	—	—	—

Analyses of a Raven soil

Location: 8-9-49-9-W5	Parent material: glaciolacustrine clays	Elevation: 900 m
Classification: Orthic Humic Gleysol	Drainage: poorly drained	Slope and aspect: 1%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L–H	12–0					
Ah	0–10	10YR 2/1 (M)	SiCL	fine granular	friable	variable thickness
Bg	10–20	10YR 4/2 (M)	SiC	fine subangular blocky	plastic	many fine mottles 10YR 5/8
Ckg	20+	10YR 5/1 (M)	C	fine subangular blocky	plastic	many medium mottles 10YR 4/6 mod. calcareous

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %		
				Ca	Mg	Na	K			sand	silt	clay
AH	7.4	6.0	0.24	26.2	11.8	0.64	0.31	38.7	100	12	58	30
Bg	7.4	1.5	0.07	18.1	11.0	0.24	0.46	28.6	100	12	47	41
Ckg	7.5	—	—	—	—	—	—	24.5	—	18	34	48

Analyses of a Stolberg soil

Location: NW32-40-11-W5	Parent material: Cordilleran till	Elevation: 1200 m
Classification: Podzolic Gray Luvisol	Drainage: well drained	Slope and aspect: 12%, E

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-F-H	5-0					
Ae1	0-4	10YR 5/1 (M) 6/2 (D)	SiL	weak fine platy	very friable	Quartzite, pebbles in all horizons; vegetation: lodgepole pine-trembling aspen-black spruce
Bf	4-14	7.5YR 4/4 (M) 6/4 (D)	SiL	weak medium granular	very friable	
Ae2	14-22	10YR 5/4 (M) 7/3 (D)	L	weak medium platy	very friable	
Bt1	22-45	10YR 4/3 (M) 6/3 (D)	SiL	moderate medium subangular blocky	friable	
Bt2	45-65	10YR 3/3 (M) 5/3 (D)	CL	moderate medium subangular blocky	friable	
BC	65-101	10YR 3/3 (M) 5/2 (D)	L	weak medium subangular blocky	firm	
Ck	101+	10YR 3/3 (M) 5/2 (D)	L			

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %			Fe + Al	
				Ca	Mg	Na	K			sand	silt	clay	oxal. extr.	pyro. extr.
L-F-H	5.5	62	1.15	—	—	—	—	—	—	—	—	—	—	—
Ae1	5.0	1.5	0.05	2.7	0.8	tr	0.2	9.9	37	35	59	6	0.7	0.08
Bf	6.0	2.2	0.08	4.8	1.1	tr	0.6	19.2	34	33	56	11	2.21	0.78
Ae2	5.7	0.5	0.02	4.8	1.4	tr	0.2	9.5	67	44	45	19	0.35	0.14
Bt1	5.3	0.8	0.05	14.0	4.7	tr	0.6	25.7	75	24	57	19	0.52	0.34
BC	6.3	—	—	21.0	5.4	tr	0.3	30.2	88	34	44	22	0.51	0.14
Ck	7.6	—	—	—	—	—	—	—	—	34	46	20	0.44	0.08

Analyses of a Sunchild soil

Location: SE29-49-13-W5	Parent material: fluvial or lacustrine silts	Elevation: 1015 m
Classification: Brunisolic Gray Luvisol	Drainage: moderately well drained	Slope and aspect: 5%, NE

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-H	2–0					
Ae1	0–5	10YR 4/4	SiL	strong medium platy	very friable	
Bf	5–10	7.5YR 5/4	SiL	moderate medium platy	very friable	
Ae2	10–23	10YR 6/4	SiL	moderate medium platy	very friable	
Bt	23–53	10YR 5/3	SiCL	strong fine blocky	firm	
BC	53–83	10YR 4/3	SiCL	amorphous	firm	
IICk	83+	10YR 4/3	L-SL	amorphous	firm	very stony till

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g Ca	Mg	Na	K	CEC meq/ 100 g	Base sat. %	Particle size distribution, % sand	silt	clay	Fe + Al oxal. extr.	$CaCO_3$ %
L-H	6.0	—	—	30.2	7.7	—	2.02	51.1	78	—	—	—	—	—
Ae1	5.8	1.6	0.08	4.2	2.0	0.02	0.65	9.6	72	15	77	8	0.42	—
Bf	6.0	1.1	0.08	1.7	2.1	0.02	0.48	11.1	41	15	76	9	1.39	—
Ae2	5.3	0.4	0.03	6.3	2.7	0.09	0.17	10.0	92	17	66	17	0.32	—
Bt	5.1	0.7	0.03	13.3	5.1	0.07	0.37	20.4	92	15	53	32	0.52	—
BC	5.2	—	—	13.2	5.6	0.05	0.34	20.2	95	17	54	29	—	—
IICk	7.5	—	—	15.6	5.2	0.03	0.22	13.8	100	51	31	18	—	7.3

Analyses of a Tolman soil

Location: NE11-48-7-W5	Parent material: fluvial and lacustrine sediments	Elevation: 850 m
Classification: Orthic Gray Luvisol	Drainage: well drained	Slope and aspect: 1–2%

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
Ah	0–1	10YR 2/2	L	fine granular	friable	
Ae	1–16	10YR 5/3	SL	fine platy	nonfriable	
Bt	16–45	10YR 4/3	CL	fine subangular blocky	firm	
Ck	45+	2.5Y 4/4	VFS		firm	calcareous

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g Ca	Mg	Na	K	CEC meq/ 100 g	Base sat. %	Particle size distribution, % sand	silt	clay
Ah	7.0	30	0.98	58.8	8.0	—	1.0	73.8	92	—	—	—
Ae	5.5	1.1	0.05	4.0	1.2	—	0.5	8.6	66	41	52	7
Bt	5.5	1.0	0.05	15.5	5.0	—	0.5	21.3	98	40	29	31
Ck	7.3	5.1	0.04	—	—	—	—	15.0	—	52	27	21

Analyses of a Wildhay soil

Location: NW27-48-14-W5	Parent material: Cordilleran till	Elevation: 1035 m
Classification: Podzolic Gray Luvisol	Drainage: moderately well drained	Slope and aspect: 5-7%, SW

Horizon	Depth cm	Color: dry, D moist, M	Texture	Structure	Consistence	Comments
L-H	5-0					
Ae1	0-4	10YR 7/3 (M)	SiL	weak platy	very friable	vegetation: trembling aspen, white spruce
Bf	4-14	7.5YR 4/3 (M)	SiL	weak platy	friable	
Ae2	14-26	10YR 6/3 (M)	SiL	weak medium platy	friable	
AB	26-33	10YR 5/4 (M)	CL	medium subangular blocky	firm	
Bt	33-53	10YR 5/4 (M)	CL	subangular blocky	firm	
C	53+	10YR 5/4 (M)	L	massive	firm	

Horizon	pH in H_2O	OM %	N %	Exchangeable bases meq/100 g				CEC meq/ 100 g	Base sat. %	Particle size distribution, %			Fe + Al oxal. extr.
				Ca	Mg	Na	K			sand	silt	clay	
Ae1	5.2	5.3	0.13	1.56	0.26	0.05	0.37	16.7	13	25	65	10	0.77
Bf	5.8	3.0	0.10	2.50	0.17	0.08	0.23	14.8	20	25	62	13	1.36
Ae2	5.5	0.5	0.03	3.75	0.46	0.04	0.22	9.9	45	29	60	11	0.51
AB	5.3	0.6	0.03	13.9	3.00	0.05	0.38	21.5	80	27	42	31	0.61
Bt	5.3	0.6	0.03	14.7	3.23	0.11	0.45	21.6	86	27	42	31	—
C	5.7	0.6	—	13.9	2.56	0.11	0.36	19.4	87	44	32	24	—